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Synchronous Communication Tools:
Enabler for the Deaf and/or Hard-of-Hearing Colleagues

By

Yaël D. Agriss

Thesis submitted in partial fulfillment of the requirements for the
degree of Master of Science in Information Technology

Department of Information Technology
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July 3, 2001

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Synchronous Communication Tools: Enabler for the deaf and/or hard-of-hearing colleagues

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Abstract

Deaf and/or hard-of-hearing and hearing people communicate frequently. Most people find it enjoyable in some situations and scary in others. We spend most of our waking hours communicating. Communication affects our life.

This is a study to investigate the use of synchronous communication tools, in particular focusing on two target groups, the deaf and/or hard-of-hearing and their hearing colleagues.

The aim will be to determine people's views on whether synchronous communication tools are now or will be beneficial for them to use as communication.

The point of the survey and interview was to ascertain who, if anyone, was actually using the synchronous communication tools. It was discovered that some people do use synchronous communication as a part of "access communication" between deaf and/or hard-of-hearing and hearing people in the workplace.

Introduction

Online synchronous communication occurs when participants are interacting in “real-time.” Everyone is logged on at the same time.

Chat groups provide one example of real-time discussion. Participants communicate or “talk” by typing text. The software indicates who is speaking. Chat software often allows participants to create “rooms” for specific topics of discussion.

Synchronous communication tools can include text-based application sharing, chats, electronic meeting rooms, electronic whiteboards, and instant messaging. These conferencing tools allow users to communicate with other participants. They also can edit or annotate the same files, draw on a shared whiteboard or browse the web together. Offices across private industry and the federal government are adopting these and other, related synchronous communication tools to increase their efficiency and effectiveness.

The underlying purpose of this thesis is to provide deaf and/or hard-of-hearing and hearing colleagues in private industry and the federal government with a basic introduction to synchronous communication tools, important technological trends, and their associated regulatory framework and industry structure. This will be integrated information about issues surrounding the accessibility and usability of synchronous communication tools for the deaf and/or hard-of-hearing, demonstrating how rapidly evolving synchronous communication tools can be particularly beneficial in the workplace. The focus of the thesis is on communication between deaf and/or hard-of-hearing and hearing colleagues, and it is primarily intended for those colleagues without a strong technical background. My aim is to provide them with a better understanding of the implications and potential utility of synchronous communication tools for deaf and/or hard-of-hearing and hearing colleagues in private industry and the federal

government. There are a number of synchronous communication tools on the market providing choice among products that are affordable as well as freeware.

Hypothesis

My thesis focuses on the impact of synchronous communication tools used in the workplace among deaf or/and hard-of-hearing colleagues and their hearing colleagues. I hypothesize that many deaf or/and hard-of-hearing and hearing colleagues don't realize that synchronous communication tools are other modes of communication available for deaf or/and hard-of-hearing people. Hearing colleagues can use these tools to increase and/or enhance communication with deaf and/or hard-of-hearing colleagues.

Based on the above, there are several sub-hypotheses:

- a. Use of synchronous communication tools increases interaction between deaf or/and hard-of-hearing colleagues and hearing colleagues;
- b. The more positive deaf or/and hard-of-hearing and hearing colleagues' attitudes toward collaboration, the higher the increase in people's individual and collective use of these tools; and
- c. Use of synchronous communication tools will increase deaf and/or hard-of-hearing and hearing colleagues' positive attitude toward collaboration on the Internet.

I have three reasons for my three sub-hypotheses:

1. Synchronous communication tools are increasing in the marketplace.
2. Deaf and/or hard-of-hearing people are able to benefit from synchronous communication tools.
3. This is a good way to increase the awareness of hearing colleagues because there are some other alternatives for communication in the workplace.

Detailed Goal and Study Design

The goal of this thesis is to collect statistics and related anecdotal information about deaf and/or hard-of-hearing and hearing colleagues' experiences using

synchronous communication tools such as application sharing, chat, electronic meeting rooms, electronic white boards, and instant messaging. This will provide those colleagues with a better understanding of the implications and potential utility of synchronous communication tools in private industry and the federal government.

Objectives

The objectives of the thesis are to understand the benefits of the following applications:

- Application Sharing
- Chat/IRC (Internet Relay Chat)
- Electronic Mail (e-mail)
- Electronic Meeting Rooms
- Electronic Whiteboard
- Instant Messaging

Scope

The scope of this thesis/project will be to investigate which synchronous communication tool capabilities are most effective for deaf and/or hard-of-hearing in the workplace. Will this help deaf and/or hard-of-hearing colleagues to be more independent? How will real-time collaboration help deaf and/or hard-of-hearing and hearing colleagues interact more effectively?

Background and Relevant Literature

The Larger Context

Language When people collaborate, they share ideas. Language is an important tool in sharing ideas. This section is about deaf and/or hard-of-hearing people's natural language, which is American Sign Language. Sign language as used by deaf adults may resemble English, or it may be American Sign Language (ASL), which has a grammar, syntax, and idioms distinct from English. People who are deaf sometimes call ASL a natural language because it evolved through use. English literacy has been and remains very important and very

difficult for many individuals who are deaf. (Gustason, 2000) "The principle of using a child's native language as a base for cognitive growth and building literacy in a second language (English) is the basic theory that drives bilingual education for hearing children from linguistically diverse homes. In the field of bilingualism, an outstanding researcher, Jim Cummins, describes the critical importance of developing a cognitive base. This cognitive base, the development of thinking skills and understanding, serves as the foundation of all future learning. Such a base is most effectively built in the native or first language of the child. Without a cognitive base, the child flounders, failing to meet his potential. Proponents of bilingual education for deaf children argue that the reason that the vast majority of deaf children never pass the third or fourth grade level in reading is because this cognitive base is never built." (Gerner de Garcia, 1992)

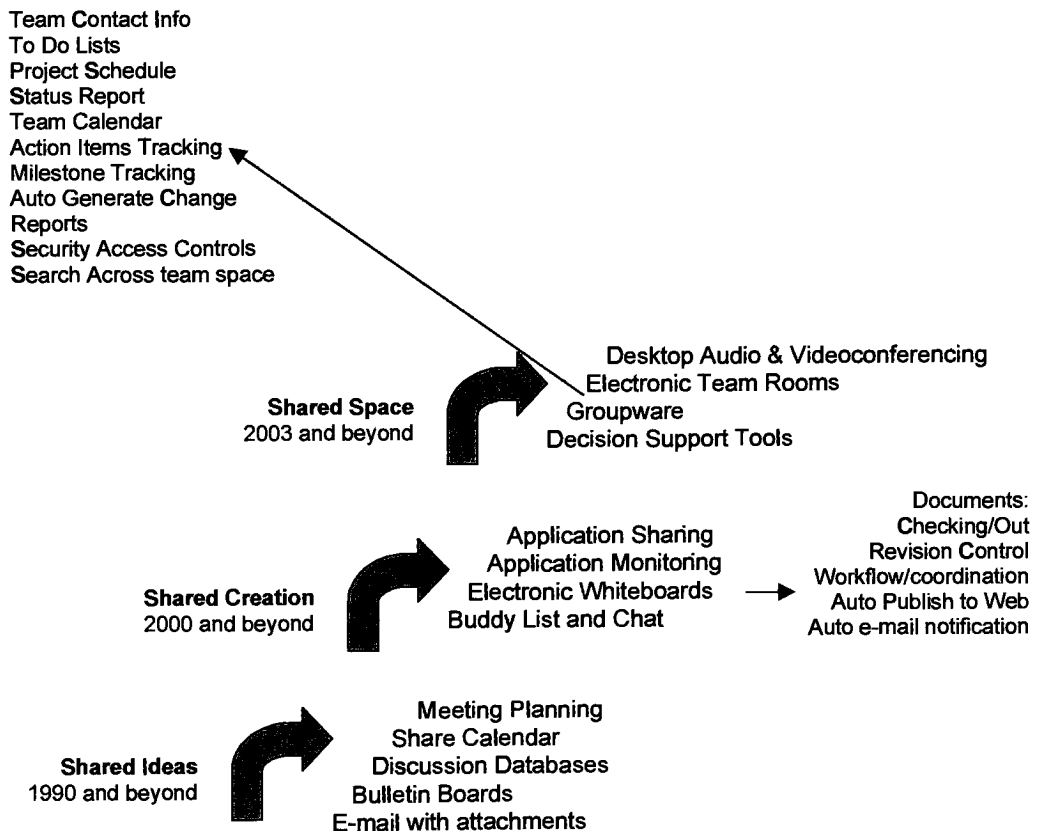
"Sign Languages are natural, with grammar independent of spoken languages. This has been demonstrated by scores of researchers beginning with Stokoe (1960). This research has shown that sign languages like ASL are natural languages because (1) they develop naturally over time among a community of users, (2) they are acquired through an ordinary course of language acquisition by children exposed to them, and (3) they are grammatically organized according to principles found in all other human languages but exhibit independent patterns of organization that make each sign language unique." (Johnson, Liddell, Erting, 1989)

Online interaction Most computer-based systems support collaboration between participants who are not working simultaneously: e-mail, discussion forums and documents systems all support people working on the same subject at different times. Technologies to support immediate, interactive collaboration (synchronous collaboration) exist, but either have been delivered and used separately from computer-based systems (e.g., audio-telephone conferences and videoconferencing) or had limited impact (e.g., chat or "instant messaging").

This is now changing. By 2002, synchronous collaboration technologies will be deployed by 70 percent of enterprises (Hayward, 1999).

Collaboration The figure below shows three eras of collaboration.

Synchronous collaboration underpins the second of the three eras of collaboration. Tools supporting such collaboration are not new, but have had little impact in businesses. Enterprises should now consider the possibilities.



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The era of shared ideas is established and maturing with the introduction of knowledge management programs in many organizations. Tools to support "shared creation" have been available for some time, but this era is now moving beyond early adopters. In part this is driven by new products, but it is also driven by the need for enterprises to improve their responsiveness.

Current products are often free-standing. After 2000, synchronous collaboration technologies will be deployed as components within other systems - either horizontal workgroup systems (e.g., Exchange and Domino) or vertical applications - not as stand-alone products (0.8 probability). (Hayward, 1999) As workgroup systems evolve to meet extended and more various user needs, they also have to accommodate the shifting architectural foundation driven by Internet technologies and network computer architecture. This will challenge vendors to another round of architectural evolution of workgroup systems.

In addition to workgroup systems vendors, there is an opportunity for vendors not currently active in this area to create new products targeted at general usage or specific functions, such as training. Given the close relationship between synchronous collaboration and traditional telephony, scope also exists for network equipment vendors. Further opportunities exist for vendors to deliver these capabilities as service rather than as products for enterprises to install and run themselves. The clash of cultures and merging of marketplaces will make this a volatile area.

Synchronous collaboration for the era of "shared creation" requires not only the relevant tools (and the network bandwidth to support them) but also the integration of these facilities in a natural way with individual and group work practices. Past experience with the introduction of new technologies in the workplace illustrates the extent of the challenge. (Hayward, 1999)

With this kind of evolution, the communication between deaf and/or hard-of-hearing and hearing colleagues will be enhanced. Most offices are likely to have better bandwidth in a couple of years. With this kind of economy, synchronous communication tools means more than people and application working together. It crosses the entire business chain to include processes, architecture and communication.

The Internet will be an important platform of emerging technologies for synchronous communication tools will be challenging. The key is to target appropriate groups of deaf and/or hard-of-hearing and hearing workers and ensure sufficient bandwidth. Implementing tactical projects that deliver short-term benefits while retaining a strategic direction will be a balancing act. Those that rise to the challenge are likely to achieve major benefits.

The Internet Itself

The Internet is best described as a network of computers that allows individuals to participate in communication using several methods: sending and receiving e-mail, viewing and creating web pages, having discussions through usenets, using chat rooms for real-time text conversation, etc. According to studies, 30 million people worldwide had Internet access in 1996. By the year 2000 that number was expected to grow to 250 million (Killen, 1999). The Internet's rate of growth has frequently been cited as "exponential." "In July 1996, InterNet Info reported that there are 488,000 domains, with 12,881,000 "advertised" connected computers in 156 countries and territories in the United States. The figure of 12.8 million hosts represents a current annual host growth rate of 72 percent, and was very close to the predicted number based on the average growth rate over the past four years. In other words, the Internet's exponential growth rate continues unabated." (Rutkowski, 1996) Whether you conceive of the Internet as global communication, a cyberspace of international communities and cultures, or both, this new technology has implications for international business and commerce. It will also impact the production of dominant and oppositional cultural texts, cross-cultural communication, education, democratic structures, entertainment, sociology, anthropology, the formation of virtual communities, self-expression and identity formation and development, among other examples. You need not "surf" for long on the net, or "lurk" among usenet rooms to encounter a lot of hyped-up predictions about the current and future implications that the advent of the Internet will have on human civilization.

Many of these opinions laud the democratizing and empowering forms of communication that Internet access can offer through forms of horizontal communication (usenet, e-mail), and individual publication of expressive and cultural texts on the World Wide Web. Figures as diverse and well known as Tony Benn (former British Minister of Technology) and Timothy Leary have argued that computer-mediated communication (CMC) technology will provide the means for an effective and truly participatory democracy (Balka, 1994). These claims point out that the non-hierarchical structures of Internet communications, as well as the lack of the visual identity cues that predict social dominance (culture, gender, race, age, class, etc.) are absent in CMC such as the Internet. While early research into CMC supported this concept, more recent studies, particularly feminist research, have begun to document that the engendered nature of human communication does not necessarily dissipate in the CMC environment. In the late 1970s and throughout the 1980s, social psychologists studied how CMC affects group decision making, group socialization and individual behavior.

Social psychological research comparing CMC groups and face-to-face interactions has found that: (1) social equalization was higher in CMC groups; (2) group members participated more equally in discussions regardless of social demographics; and (3) that individuals were more uninhibited in CMC. While the concept of the equalizing effects of CMC have since bloomed in the popular euphoria for the communications revolution of the Internet, some social psychologists have presented an alternative model that predicts that CMC can foster equal, horizontal exchange, as well as communication that is close to face-to-face, hierarchical and socially determined processes. In their inquiry into the socialization process in CMC, Spears and Lea question the body of evidence emerging from social psychological studies that suggest that CMC can serve to reduce some of the cultural and social barriers to communication, such as status differentials, (culture, race, ethnicity, gender, age or class), resulting in greater equality of participation (Spears and Lea, 1994). Their research attempts to

show that CMC can serve both to reduce and reinforce power relations (Spear and Lea: 428). Stressing the permanence of social factors, they posit that identity and interaction in CMC are grounded in the realities of identities, relations and cultural context beyond CMC which pervade our social lives (Spear and Lea: 429). Early CMC research has been instrumental in establishing theoretical and methodological frameworks and models for the analysis of text-based, networked communication technologies. These technologies, such as Multi User Dungeons (MUD) and Internet Relay Chat (IRC), have become increasingly popular with the growth of the Internet and other technologies that use the Internet (like the World Wide Web). MUDs are virtual environments where users from different locations can interact according to the specifications, or virtual architecture, controlled by MUD applications. Most MUDs are basically networked, multi-user games. Elizabeth Reid, particularly noted for her ground-breaking research regarding MUD environments, concludes that:

MUD usage forces users to deconstruct many of the cultural tools and understandings that form the basis of more conventional systems of interaction. Unable to rely on physical cues as a channel of meaning, users of MUDs have developed ways of substituting for or by-passing them, resulting in novel methods of textualising the non-verbal (Reid, 1998).

In a way, Reid is describing the process that users go through developing new social and cultural competencies in MUD environments. MUDs and IRC are certainly part of many users' virtual experiences, yet the frameworks of these studies are not designed to understand how and why people use the variety of technologies that are now commonplace on the Internet for cultural interaction and expression.

The Internet is now a multimedia environment proliferating with products of various technologies, various cultures, various uses and users. As Bruce Overby explains in his study of social identity in usenet environments, "Cyberspace...can

be understood as a vast territory, a space of representations. While human beings have inhabited representational spaces for a very long time, we have never been able to create representations with the ease and flexibility possible in cyberspace." (Overby, 1998) It is this flexibility of expression and the ability to form expressive relationships that have enticed many individuals into this habitat. In the few years since the Internet has enjoyed exponential growth, new subcultures and old subcultures have emerged, taking advantage of all that cyberspace has to offer. It is in this light that the evolution of media use is taking place via the Internet. Participation in media is no longer limited to the audience's active engagement in the interpretation of texts. Now many types of horizontal dialogue are possible through email, chat rooms, discussion boards and usenet, real-time audio and video conferencing. Furthermore, full self-management of personal and group Websites allows almost any type of cultural and personal information to be published (either for the general public or for a select, private group). When you consider this in conjunction with the fact that the potential number and variety of choices (sites) is almost endless, it is easy to get excited about the cultural implications of this.

Considering that most of these users have only had Internet access for information, the growing importance of this technology over other domestic media is quite amazing. The authors of the Graphics, Visualization, & Usability survey results conclude that "These numbers when used in conjunction with the use of the email as being on equal par with the phone paint a tremendously strong picture of the rapid integration of the Internet and World Wide Web into the fabric of the lives of those who currently use it." (Graphics, Visualization, & Usability Center, 1997a) The most recent survey (fall 1997) shows that e-mail (84%) and the Web (82%) are by far the most used technologies (via the Internet) (Graphics, Visualization, & Usability Center, 1997b). Forty-three percent of those surveyed have created personal web pages (more than half of men and about one-third of women users).

History of Synchronous Communication Tools

There is a minimal amount of information on a history of synchronous communication tools because this field is new; however, I have found a lot of history about the Internet, how it was invented, and how it can apply to synchronous communication tools.

The first computer network was created in the late 1960s in an effort by the Department of Defense to link multiple command sites to one another, thus ensuring that central command could be carried on remotely, if one or several sites were disabled or destroyed. Once the hardware was installed, the military allowed educational institutions to take advantage of the research resources inherent in multiple site networking. This interlaced network of computer connections spread quickly, and in the early 1980s, the network was divided into MILNET, for strictly military uses, and ARPANET, which, with the advent of satellite communications and global networking, became the Internet (Reid, 1993).

On a smaller scale, throughout the 1970s, various corporations developed their own computer networks for intra-organizational interaction. E-mail and computer conferencing were created, useful for information exchange, but asynchronous and thus less interpersonal than application sharing, chat, Internet Relay Chat (IRC), electronic meeting room, electronic whiteboards and instant messaging would later become. Asynchronous software is software used to help people in a group, but not requiring the group members to work together at the same time (i.e., e-mail).

These systems were originally a central component of Group Decision Support Systems (GDSS). Unlike most groupware applications, meeting support did not emerge from product development environments, nor did papers on GDSS appear in human-computer interaction conferences. Until recently, there were no electronic meeting room products. GDSS research and development began over

20 years ago in the Information Systems (IS) field in U.S. business schools. To understand its history, consider the "D" in GDSS. Decision-making was emphasized because, until recently, management-as-decision-making was the dominant perspective in schools of business and management (King and George, 1992). In addition, expensive early systems could be justified in organizations and in a management school curriculum by narrowly focusing on high-level decision-making.

In the mid-1980s the first Computer-Supported Cooperative Work (CSCW) conferences drew GDSS researchers from the IS field. Conflicting uses of terminology went unrecognized. The IS community construed GDSS broadly to include all technology that contributes to decision-making, including electronic mail and other common applications. In fact, some in the IS field considered GDSS to be a synonym for CSCW. Encountering the term GDSS for the first time, many from the Human Computing Interface (HCI) field assumed it referred only to electronic meeting support, the one technology feature unfamiliar to them. They also thought in terms of applications, not systems.

As the cost of the technology fell, GDSS use was no longer restricted to high-level "decision-makers." It could be used to support meetings of various kinds. In addition, the trend toward corporate "downsizing" has lessened the emphasis on high-level decision-making in organizations. As rungs are removed from an organizational ladder, responsibility for decisions often shifts to the groups that implement them. As a result, the "D" was dropped to form Group Support Systems (GSS). The reduced cost, together with improved technology and a better understanding of the process of effective use (Grudin, 1994), led to electronic meeting rooms becoming commercial products around 1990.

GSS as support for projects or large groups-meeting support is not as useful with less than 5 or 6 participants. The small-group application developers who play a central role in CSCW have different priorities than the system developers working on GSSs, and few GSS papers have been accepted for CSCW conferences. In

addition, GSS researchers observed that small-systems researchers were unfamiliar with their literature. Over time, the GSS community has become less involved in CSCW. They have participated in conferences with an Information System orientation, initiated a newsletter that rarely mentions CSCW, and spawned their own journals. They have, however, adopted the "groupware" label, as has the workflow management community -- another group focused on large group support.

At the moment, the term "groupware" is found in both GSS and CSCW literatures, and is used to describe overlapping but different technologies. The divide is only partial and may be temporary. Information Systems research is still presented at CSCW meetings. Both groups can benefit from interaction. But the fragile nature of participation in CSCW is apparent.

At the same time as this conferencing research was being done, another group of programmers was involved in the creation of text-based adventure games in which a user would wander through a textually-depicted maze, occasionally encountering programmed foes with whom to do battle. These first single-user adventure games, developed in the early 1970s, expanded the world's notion of computers from mere super-cooled, punch-card-munching behemoths to a more user-friendly conception of computers as toys and even friends.

On October 10, 1996, President Clinton and Vice President Gore announced their commitment to the Next Generation Internet (NGI) Initiative, based upon strong research and development programs across Federal agencies. The Large Scale Networking Working Group of the Computing, Information, and Communications R&D Subcommittee has drafted a paper that outlines the concepts and goals of the NGI Initiative as part of the process for building the strongest possible program among academia, industry, and the government (NGI, 1997).

These advances will start to put deaf and/or hard-of-hearing and hearing colleagues on track to a next generation Internet offering reliable, affordable, secure information delivery at rates thousands of times faster than today. Achieving this goal will require several years of generic, pre-competitive research and testing. It is appropriate that the federal government promotes and participates in this research because critical federal missions require a next generation Internet for their success and because much of the needed research is too long-term or high-risk for the private sector to fund. As in the Internet development to date, success will depend on effective partnerships among universities, the private sector, and the federal research community. This is the future of synchronous communication tools and it will help the deaf and/or hard-of-hearing and hearing to communicate with each other in the workplace. The most obvious advantage of using synchronous communication tools in work place is the flexibility for colleagues to get access to computers. Now that computers have become common, colleagues can get access to the Internet and engage in collaboration at any time, any place, and at their own pace. This is the reason why synchronous communication tools have become so common nowadays.

Another advantage of synchronous communication tools is their versatility. Other than just sounds, computers can produce colorful graphics, which will greatly enhance visualize outcome, as colleagues will retain the majority of what is heard/seen through sights rather than sounds. Besides, compared with humans, computers have absolute superiority in generating attractive graphics. In a nutshell, a picture is worth more than a thousand words.

Despite the many advantages mentioned above, there are drawbacks and obstacles of using collaboration in work place. First and foremost, the colleagues' knowledge of synchronous communication tool is the most crucial factor in determining the success of using such technology in work place.

Another disadvantage seems to be that in locations where there is neither the will nor the ability to develop these consortia, they may have to wait until the use of this technology is refined.

Additional advantages and disadvantages include the following:

Advantages

On-Line Chats:

- Builds a community of learners
- Fosters immediacy and social presence

Collaborative Tools:

- Multi party conferencing
- Application sharing
- Shared whiteboards
- Audio conferencing

Closed Conferences:

- Off-line capabilities
- Public & private areas
- Threaded discussions
- System stability
- Ease of use
- Minimal encryption problems

Disadvantages

On-Line Chats:

- Typing skill requirement
- Differences in time zones
- Management of large groups
- Requires good moderation skills

Collaborative Tools:

- Lack of consistency among products
- Learning curve

Closed Conferences:

- High costs
- Extensive technical & administrative support

Synchronous Communication Tools Potential

In light of the advantages highlighted above, synchronous communication tools hold particular promise for deaf and/or hard-of-hearing colleagues because they can improve communication with hearing colleagues in the workplace.

Traditional communication tools included text telephone and the telecommunication relay service. Text Telephones (TTY) are terminals used for two-way text conversation over a telephone line. It is the primary tool used by deaf people and some hard-of-hearing colleagues for telephone conversation. Telecommunication Relay Service (TRS) provides a bridge between hearing people who communicate by voice only and those deaf people who communicate by TTY (with or without a voice component). TRS is designed to allow real-time conversation by providing third-party assistance at no cost to the users. A trained communication assistant speaks the words typed by a TTY user, and then types the words spoken by a voice telephone user. Some deaf and/or hard-of-hearing colleagues use word processing to communicate with hearing colleagues one-to-one. In addition to TTY and TRS, the federal government and some companies use interpreter services for meetings. These products and services have long been useful for the deaf and/or hard-of-hearing.

In the past decade, e-mail, as an asynchronous communication tool has become a valuable device for deaf and/or hard-of-hearing colleagues. This can, however, be frustrating for deaf and/or hard-of-hearing colleagues because they are not able to participate immediately in discussions. Many of them have a lot of great suggestions but have to follow up with e-mail until after the meeting. This wastes time. If we make use of synchronous communication tools, it may save valuable time in the decision-making process because everyone is able to participate and discuss ideas in the meeting at the same time.

The long-term trends in synchronous communication tools hold out even more promise for the future. One concept, advanced by Collaborative Strategies, LLC's David Coleman predicts that electronic collaboration will increase the

ability of people to interact with each other through the computer on an ongoing basis for a specific reason or goal (Coleman, 2000). He emphasizes interpersonal or social interaction because he believes that is where 80% of the value of electronic collaboration is; the other 20% of the value is in the infrastructure, tools, and enabling technologies that now make this type of interaction possible and much less expensive. This concept is as appealing to the deaf and/or hard-of-hearing as it is to the general public. Likewise, the concept of including all modes of electronic communications -- voice, data, image (graphics) and video -- in a single interface has considerable appeal to the both deaf and/or hard-of-hearing and the public generally. In my opinion, it will increase the ability to communicate anytime, anywhere, in any mode. Coupled with the power of intelligent, programmable networks and end-user equipment, it will create a potent platform to serve deaf and/or hard-of-hearing colleagues and subscribers. If the technology and marketplace support this vision of the future, synchronous communication tools will revolutionize communications -- not only for the general public, but also for deaf and/or hard-of-hearing Americans as well.

According to the article "Good Bye TTY?," instant messaging (IM) has grown into a powerful business tool. It is the fastest growing Internet application, with over 1 billion IMs being sent every day. Currently, there are more than 130 million users worldwide, with an astronomical three million users signing up every month. IM technology is so popular, it has proliferated into various versions such as AOL's Instant Messenger, MSN's Messaging Service, and Pow-wow's Tribal Voice. Yahoo, Excite, MultiMate, iCast and Alta Vista also provide their own version of IM. However, AOL has a dominant lead in IM, controlling over 90% of the market.

For the worksite, the benefits of IM are clear. In addition to the productivity that comes with the ability to send a quick, real-time instant message, there is other notable productivity enhancements. One is you can track the online presence of your "buddies", or co-workers, so you always know if they are there or not. For the deaf and/or hard-of-hearing, IM brings everything that TTY provides: text-based communication, instantaneous response and the ability to print

conversations. In addition, IM is an efficient and very cost-effective medium (its costs nothing to download) for hearing co-workers and supervisors to communicate effectively with deaf and/or hard-of-hearing employees. The historical barrier to communication is minimized as the communication facilitator, whether an interpreter, co-worker, laptop or communication access realtime translation (CART) reporter, is removed from the conversational process.

IM removes for hearing peers the responsibility of learning and applying standard TTY protocol such as "GA" (Go Ahead) and "SK" (Stop Key) as well as how to identify an incoming TTY call, and how to connect it to the phone. For offices that serve the public directly, the need for them to provide a TTY number for deaf and/or hard-of-hearing people to call for information is alleviated. IM also eliminates the need for Telecommunication Relay Services.

Another benefit of IM in the worksite is the ability to hold office meetings in the chat room, which obviously alleviates the need for a communication facilitator if one can not be located. This also provides a reasonable alternative if the meeting must occur immediately and an interpreter could not be located. In addition, it alleviates the need for a note taker at the meeting because the conversation can be printed.

The only arguments against IM as an alternative communication medium are interoperability and security. Interoperability allows people to communicate with co-workers and friends regardless of what IM version they use. AOL IM users, for example, can attest to their dismay and frustration at being unable to communicate with their "buddies" who use MSN or Yahoo. Some agencies' IT Security officers allege their servers could be infiltrated with viruses because of the live continuous link associated with IM. However, their concerns have been unfounded as there has been no reported cases, whatsoever, of this occurring. Because IM is an Internet application, it is no different from a browser, and it works on the same Internet Protocol. If security is still an issue, then the agency could purchase a license and operate it on its internal web server. This way, IM

would be Intranet-based instead of Internet-based, protected by internal firewalls. Further, all users would share the same version, whether AOL or Yahoo. Thus, interoperability would not be a problem. (Ball, 2001)

Access

As long as new and/or advanced technologies are limited or specialized, access to them is less likely to be important to an individual participating fully in society. But when technologies become pervasive, rather than limited or specialized, concerns over their accessibility and usability escalate. Without access to these broadly available and essential new capabilities, deaf and/or hard-of-hearing colleagues can become isolated rather than empowered. Examples of this abound. When the first telephones were introduced, they were probably not of great concern to people who were deaf. When the telephone came to dominate personal and commercial communications, however, the effect was devastating because deaf and/or hard-of-hearing people could not use the telephone until TTY was invented. (Hatfield, 1997). Similarly, access to early, text-based, computer systems were relatively straightforward for blind people. Therefore, they enjoyed enhanced access to print, communications, and new opportunities for employment. Then, when the graphical user interface became the office standard for personal computers, it severely threatened all of this progress (Hatfield, 1997).

The use of synchronous communication tools has been increasing dramatically over the last several years. For instance, prior to the 1980s, there were relatively few computer users in the United States. With the development, licensing and proliferation of the Internet, however, the number has grown to millions (Coleman, 2000). Synchronous communication tools are an advantage in the workplace. For example, when a deaf and/or hard-of-hearing individual is looking for a job, the most common question during the interview is “How can we communicate with you?” .

Thus, to summarize, the rapid evolution of synchronous communication tools is significant to deaf and/or hard-of-hearing colleagues for at least two reasons. On the one hand, the evolution (some would say revolution) holds particular promise because it can enhance communication. On the other hand, experience has shown that if these synchronous communication tools are not designed, developed, and fabricated to accommodate individuals who are deaf and/or hard-of-hearing, these individuals will remain isolated rather than empowered.

Existing Problem

There are 20 million deaf and/or hard-of-hearing people in the United States, according to demographic information from Cole, Holt, and Hotto (1994). The statistical information has shown that only 43% of the deaf and/or hard-of-hearing are employed. Many hearing colleagues don't realize that there is quite a large deaf and/or hard-of-hearing population in the United States. Some people are never exposed to the deaf and/or hard-of-hearing, so they have no idea about their potential. There are barriers for the deaf and/or hard-of-hearing in getting jobs because they can't hear, talk, or lip-read. Synchronous communication tools could open the door to the deaf and/or hard-of-hearing to get jobs and have equal access to job opportunities.

Theory and Technology

Problem Description

I want to examine the workplace interaction among deaf and/or hard-of-hearing colleagues and hearing colleagues using real-time collaboration's synchronous communication tools. Synchronous technology is based on software used to help geographically dispersed people work together in groups over the Internet. These groups may need to meet online to brainstorm and analyze some new information, then to incorporate their thoughts into a presentation for management and, finally, to change a report they are writing for the final product they will deliver. The purpose of this thesis on real-time collaboration is to

present the pros and cons of this technology as it is used for workplace interaction between deaf and/or hard-of-hearing and hearing colleagues. Most companies and the federal government don't realize how many deaf and/or hard-of-hearing and hearing colleagues are using the Internet daily in the workplace. It seems likely that the high demand for synchronous communication tools will continue for years to come. How can private industry and the federal government benefit from increased use of synchronous communication tools in the workplace? How do companies and the federal government lose out when deaf and/or hard-of-hearing and hearing colleagues' full access to the Internet is restricted? How can technology help? These are the questions that are explored on this thesis.

This thesis covers the following:

1. Attitudes toward synchronous technology

- a. Will people be willing to learn more about synchronous communication tools and apply them to their daily work assignments?
- b. Is software too expensive?

2. Degrees of proficiency in standard English

- a. Will deaf and/or hard-of-hearing people (who use English as a second language) be able to converse comfortably in English?
- b. Will hearing colleagues discriminate or downgrade the intelligence of deaf and/or hard-of-hearing people whose English appears to be weak/poor?

Approaches to Solving the Problem

There is plenty of research regarding synchronous communication tools on the Internet, in books, magazines, and newspapers; however, none of it discusses the topic of synchronous communication tools and the deaf and/or hard-of-hearing in the workplace, or whether this technology can open the door to them. I believe that this technology will bring deaf and/or hard-of-hearing and hearing

colleagues closer together. Before e-mail was invented, some individuals had worked in the same place for 20 years and never chatted with the person at the next desk. The reason that they never chatted is because the hearing person may have been afraid of communicating with the deaf and/or hard-of-hearing employee because of the assumption that some deaf and/or hard-of-hearing employees are not smart enough (Lawson, 2000). But the paradigm is now shifting. Currently, when deaf people seek employment with the federal government or a company, they should consider synchronous communication tools that are available out there that can assist communications and highlight their contributions in the workplace.

Research and Implementation

To examine the questions outlined above, I employed a combination of surveys, interviews, and a literature search. I collected and analyzed data from deaf and/or hard-of-hearing colleagues and hearing colleagues to see if they are using synchronous communication tools in the workplace. I asked deaf and/or hard-of-hearing colleagues if they use on-line synchronous communication tools such as application sharing, chats, electronic meeting rooms, electronic white boards, and instant messaging, as a part of their job. If they do, I also questioned them about what they consider the benefits and drawbacks to be. I inquired about deaf and/or hard-of-hearing colleagues' and hearing colleagues' collaborations doing the same type of work. If affirmative, I asked if they thought the benefits they got from working in an on-line collaboration environment would be lessened or enhanced when working with a deaf employee. If they said they normally would not choose to use these tools, I asked them why. How do they feel about having to use them in a situation where they normally would not? Has working with a deaf employee using these tools on this type of project changed how they would feel about doing this in the future?

I conducted a literature search on synchronous communication tools via Internet, books, magazines, newspapers, and training pamphlets to provide the

background for my research. I developed a web-based, quantitative survey of deaf and/or hard-of-hearing colleagues and hearing colleagues with the goal of collecting statistics and attitudes of deaf and/or hard-of-hearing colleagues and hearing colleagues who are collaborating by using synchronous communication tools. I aimed for a total of approximately 100 deaf and/or hard-of-hearing and hearing colleagues to participate in the survey. I conducted 20 qualitative interviews with deaf and/or hard-of-hearing colleagues and hearing colleagues who collaborate using these tools.

The survey was the fastest and easiest way to get instant feedback from website visitors. The people who were qualified to do the survey picked out one answer from multiple answers by using the radio button and filled in comments in text areas. The survey tracked those opinions with the simple click of a button. This also generated statistics that I then used in my research and that people taking the survey could view. I developed a site to host the survey. I created the survey by using HTML and people could access the site to complete the questionnaires. I used radio buttons for picking out the answer that applies to the question. Respondents who participated in the survey were not be able to skip a question, as it required them to answer all of the questions before the survey could submitted. It had an IP address checking feature to make sure that they filled out the survey only once.

My prediction was that deaf and/or hard-of-hearing employees were more likely to experience the impact of synchronous communication tools technology because their communications at the workplace are limited. As for hearing employees, it would have less of an impact because they have a lot of options other than synchronous communication tools unless they are working closely with deaf and/or hard-of-hearing employees. I expected that hearing employees would be comfortable to chat online with the deaf and/or hard-of-hearing even though their English is considered as a second language because most of them would prefer to type their English in vernacular.

I anticipated that might be difficult to find deaf and/or hard-of-hearing and hearing colleagues who used synchronous communication tools in the workplace because the technology is still a new trend. Some are not allowed to use them in the workplace because of security issues. I believed that e-mail is still the most powerful tool, and although it is considered as an asynchronous communication tool, it is a bridge to synchronous communication tools.

I sent out a formal invitation, including an introduction of myself along with the website address where people could find the survey. These were sent to deaf organizations, my friends, and people at other agencies and some private industries. [Please refer to Appendix A at the end of this thesis to see a draft version of the invitation letters and the survey questionnaires.] I chose the potential respondents from the Deaf Directories via the Internet, the "red book" of Metropolitan Washington, the Telecommunication Directory for the Deaf and Hard-of-Hearing "blue book" of Telecommunications for the Deaf, Inc. Directory, and the U.S. Government 1999 TTY Directory. I was a committee member and an assistant workshop coordinator for this year's Deaf and Hard-of-Hearing In Government (DHHIG) National Training Conference (NTC). I gave out 200 letters to these people who attended this conference from April 9th to 11th, 2001 in Bethesda, MD.

I was able to get 44 deaf and/or hard-of-hearing colleagues to complete the survey. As for hearing colleagues, I was able to get 37 colleagues to participate. The total number of participants is 81 colleagues, which is more than the 75% necessary to complete the statistical work.

I identified several colleagues who were collaborating by using synchronous communication tools and interviewed them to see how they felt about it. I wanted to know if there had been an improvement for deaf and/or hard-of-hearing colleagues, including an increase in their promotion potential. I did not plan to follow-up with people after the survey was completed, and instead interviewed

the most qualified ten deaf and/or hard-of-hearing colleagues and ten hearing colleagues.

Detailed Timeline

Milestones	Estimated Completion Date
Develop proposal	October 23, 2000
Research on synchronous communication tools and software	November 2000
Select thesis committee members	November 2000
Finalize proposal	December 2000
Obtain signatures on proposal form	December 2000
Schedule meetings with committee members	December 2000
Review with committee members	December 2000
Submit the proposal form	January 2001
Develop survey	February 1, 2001
Research ongoing projects in real-time collaboration and synchronous communication tools	March 5, 2001
Evaluate of different approaches of synchronous communication tools	February 15, 2001
Collect the survey	April 15, 2001
Develop first draft of thesis; get comment from thesis committee members	April 17, 2001
Update first draft, then review with committee members	April 25, 2001
Complete thesis	May 2001
Submit result to IT department	May 2001
Obtain signature for Approval Form	May 2001
Submit a final copy	May 2001

Knowledge and Skills

- Find out more about synchronous communication tool software.
- Find out which federal government agencies and companies have deaf and/or hard-of-hearing colleagues in the workplace.
- Find out which federal government agencies and companies use synchronous communication tools.

Methodology

Step Descriptions

The next several pages describe the step I took to conduct my thesis research.

Step 1: Prepared questions for the survey. I selected five to ten deaf participants and five to ten hearing participants to look at the survey via the study website to see if they could understand the questions. Is the survey user friendly? In this way I could get feedback before I actually sent it out to the federal government and private corporations.

Step 2: Identified 50 deaf and/or hard-of-hearing colleagues and 50 hearing colleagues who were using the Internet in the workplace to see if they were using synchronous communication tools. The hearing colleagues had to have experience in communicating with deaf and/or hard-of-hearing colleagues in their workplace in order to be participants in my research. To amass a sufficient number of individuals for my survey, I invited people at my agency, other federal agencies, and private companies to participate.

Step 3: Conducted interviews. Some workplaces didn't make use of synchronous communication tools. I set up an interview with ten deaf and/or hard-of-hearing and ten hearing colleagues to determine why they didn't have any synchronous communication tools.

Step 4: Fine-tuned the survey. After testing all the draft questions, I wrote narrower and more specific questions. Among other things, I planned to ask colleagues who had reviewed the survey what future development of synchronous communication tools they would like to see and what are the possible disadvantages of synchronous communication tools might be. Then I made some final adjustments on the survey questions to fit and support my research plans. I sent a final survey to 50 deaf and/or hard-of-

hearing colleagues and 50 hearing colleagues. I sent an e-mail with an introduction, purpose statement and URL address where they could complete the survey. I explained who was qualified to do this survey. Because there were two sets of questions - one designated for deaf and/or hard-of-hearing and another for hearing colleagues, there were two different surveys.

Step 5: Began evaluating survey responses. Once I received about 60% of the number required for completion of surveys from deaf and/or hard-of-hearing and hearing colleagues, I developed statistics on the number of colleagues using synchronous communication tools in the workplace. I showed the success rate with this kind of technology. Is this technology available to deaf and/or hard-of-hearing colleagues at the workplace in the future?

Step 6: Finished survey response evaluation and began writing my thesis. With 75% of the responses from both the deaf and/or hard-of-hearing and the hearing survey, I began to write my thesis and explain in detail how synchronous communication tools can improve the interaction between the deaf and/or hard-of-hearing and hearing colleagues in the workplace. I hoped to show that deaf and/or hard-of-hearing and hearing colleagues could interact effectively via synchronous communication tools.

Step 7: Conducted an open forum on synchronous communication tools at the National Training Conference on April 1, 2001. About 50 people showed up for my forum. I gave a PowerPoint presentation about synchronous communication tools. At the end, we all discussed several issues:

- Do you think these tools will help deaf and/or hard-of-hearing employees?
- Do you think these tools will facilitate your skills with hearing employees?

- Do you feel that these tools will lead people to have fewer face-to-face interactions with other people?

Resources

Hardware and Software

There were no hardware or software requirements because it was a web-based survey.

Website

I developed the website via Dreamweaver 3 on aboutme.htm, contact.htm, index.htm and survey.htm. As for the deaf_survey.htm, hearing_survey.htm and thesis.htm, I developed my own script with HTML 4.0 and JavaScript 2.0.

Technical information

The deaf and/or hard-of-hearing and hearing surveys were developed using Common Gateway Interface (CGI) script. When people were doing the survey, they would be able to see the result after they submitted the survey.

I used PERL 5 for Windows 98 and NT. PERL is an interpreted high-level programming language. It has become the premier scripting language of the Web, as most CGI programs are written in PERL. It is popular with system administrators, who use it for an infinite number of automation tasks. PERL's roots are in UNIX, and I have a Grace account with the Rochester Institute of Technology. Grace is the public Digital UNIX cluster. It is the platform used for public web pages at RIT.

Additionally, I worked with Excel 2000 on Windows 98 to generate the statistics for my research. Excel 2000 is a spreadsheet to convert data from the completed surveys. It can take advantage of comprehensive tools to create spreadsheets and share them on the Web for universal viewing and collaboration. It is easy to analyze the data after being generated from PERL.

Execution

The Surveys were executed on the Rochester Institute of Technology's server. All HTML pages were generated on the fly via my survey engine (written in PERL).

Sources

I used Dreamweaver 3 to develop the website. I found a good CGI script source on the Internet. I built the questionnaire and got statistical information there.

Interview and Survey

Interview and Survey Population

Participants who were part of the collaboration focused on professional relationships between deaf and/or hard-of-hearing and hearing colleagues. The hearing colleagues had to have at least some experience communicating with deaf and/or hard-of-hearing colleagues in their workplace in order to be participants in the survey.

The interview

There were ten deaf and/or hard-of-hearing colleagues, ten hearing colleagues and three special researchers. The colleagues' relationship could be co-worker, supervisor, or team member. The interview could be done in person or via Instant Messaging, if the colleague had that capability at work or home.

Web-based survey

Fifty deaf and/or hard-of-hearing colleagues and fifty hearing colleagues from across the nation participated. All took part in a web-based survey that I developed.

Treatment

The treatment was a web-based survey designed to see if deaf and/or hard-of-hearing and hearing colleagues were using the synchronous communication tools in their workplaces.

Respondents to the survey explained about their experience with synchronous communication tools such as instant messaging, chat/IRC [Internet Relay Chat], electronic white boards and electronic meeting room. They also indicated which application they used the most in the workplace. Demographic information in the survey indicated which group was using the synchronous communication tools the most. If there was a particular interest, it could lead to new possible outcomes through advanced synchronous communication tools. Therefore I looked at the engagement and increasing use of synchronous communication in the workplaces.

Procedure

Deaf and/or hard-of-hearing colleagues had to have at least one kind of synchronous communication tool in their workplace in order to be participants in the survey. The use of these tools by deaf and/or hard-of-hearing and hearing participants would support the thesis that synchronous communication tools are one mode of communication in the workplace. It can be debated why these tools were not often used in the workplace: lack of bandwidth, not enough funds, no allowance to use it, too many of distractions, etc.

I sent out a letter requesting an interview to ten deaf and/or hard-of-hearing people and ten hearing people in government and ten deaf and/or hard-of-hearing people and ten hearing people in private companies. I also sent out a letter to three researchers who have been studying collaboration for a long time. Most were people I knew from college days, and some were referred to me by colleagues and friends. Twenty-one people accepted my request for an interview.

Data Collection

The data collection was based on the survey and interview to determine if synchronous communication tools were one of the modes of communication in the workplace. The data would measure the effectiveness of synchronous communication tools and efficiency of the interaction between deaf and/or hard-of-hearing and hearing colleagues in the workplace.

The survey was composed of 24 questions for deaf and/or hard-of-hearing colleagues and 23 questions for hearing colleagues. They were scaled to measure the attitudes toward synchronous communication tools throughout the entire survey and interviews. Hearing questionnaires have one question less than deaf questionnaires because there is a question related to deaf's culture that is not applicable to hearing people. Refer to Appendix A, survey and interview questionnaires section to review the questions and an example of the respondent scale. Some categories that I looked for were attitude, awareness, collaboration consequence, interaction, informational, and management.

Findings & Analysis

Initially, two methodologies were to be used in the form of questionnaires and interviews. Upon further discussion, it was decided to incorporate observation and focus groups into the methodologies.

Questionnaires

A simple questionnaire was designed and distributed among two groups. These groups consisted of deaf and/or hard-of-hearing and hearing people who used the synchronous communication tools in the workplace.

By distributing the questionnaires among two target groups, I hoped to establish individuals' knowledge of computer technologies and whether they use synchronous communication tools or, alternatively, their viewpoint on synchronous communication tools.

Interviews

Personal interviews were also conducted, with five deaf government employees, three hearing government employees, five deaf private employees, five hearing private employees, and three special researchers.

Observations

Observations were carried out on individuals who used synchronous communication tools to determine how easy or difficult it was to access synchronous communication tools via Internet.

Focus Groups

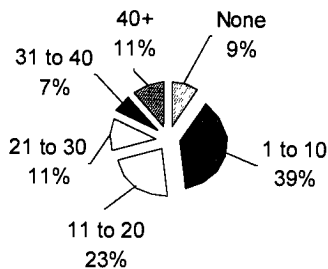
Small focus groups were formed to discuss in detail their awareness of synchronous communication tools and to provide more in-depth discussions as to why individuals believed it would either be a fad or a future trend. Articles were used in thesis discussions and the viewpoints of various people were analyzed.

Questionnaire Findings

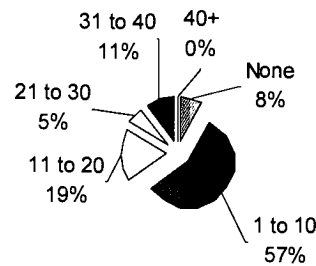
Questionnaires were distributed among people via e-mail to see if they are using synchronous communication tools in the workplace. My initial assumptions were that most people using synchronous communication tools at home would consider upgrading synchronous communication tools in the workplace. There were 44 deaf and/or hard-of-hearing respondents and 37 hearing respondents. The data received a p-value of .0624, suggesting that the result of this sample is statistically significant and therefore reflects the larger population.

Question 1: The percentages showing that the colleagues have spent ____ hours per week using the synchronous communication tools:

Deaf and/or hard-of hearing's responses



Hearing's responses



Quite a high percentage of the people questioned did have some synchronous communication tools in the workplace, which is not surprising to me. However, e-mail and instant messaging are the most used in the workplace. Furthermore, all those who are using synchronous communication tools stated they were aware of synchronous communication tools but were not considering upgrading. Various reasons were given for this. Some of the reasons include:

Deaf and/or hard-of-hearing

- Audio required
- Don't like being interrupted
- Still in the process of getting approval and security clearance

Hearing

- Not successful
- Communicate primarily through e-mail
- No experience with these technologies

Both

- Lack of bandwidth
- Security is not approved

With regard to the statement that "the technology is not advanced enough," it remains to be seen whether the next generation technology will make synchronous communication tools that more that is attractive to prospective colleagues. This new generation of synchronous communication tools have improved on reliability, interoperability, and ease-of-use. (Davis, 1999)

Referring to insufficient synchronous communication tools in the workplace, in order to access them, these tools should have a higher bandwidth or resolve security issues as a part of "communication access" in the workplace for the deaf

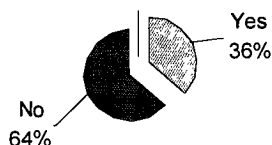
and/or hard-of-hearing colleagues. Many government agencies and private industry have been slow in converting their fiber optics which limits the amount of accessing of synchronous communication tools such as electronic meeting rooms and electronic white boards. Other people are not allowed to use the synchronous communication tools in the workplace at all.

One of the main aims of this was to establish whether those questioned felt that synchronous communication tools were beneficial for them to communicate with each other.

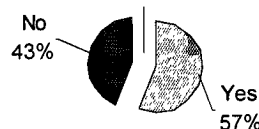
Question 2: A multi-part question – attempted to identify why synchronous communication tools colleagues are not using in the work place.

2. Colleagues find application sharing important:

Deaf and/or hard-of hearing's responses

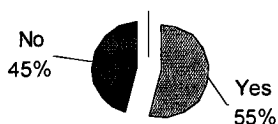


Hearing's responses

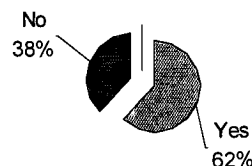


2. Colleagues find chat/IRC important:

Deaf and/or hard-of hearing's responses

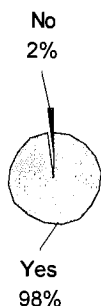


Hearing's responses

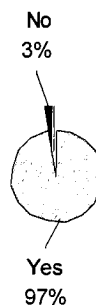


2. Colleagues find electronic mail (e-mail) important:

Deaf and/or hard-of hearing's responses



Hearing's responses

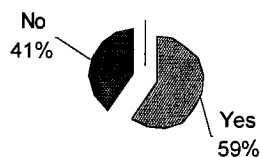


2. Colleagues find electronic meeting rooms important:

Deaf and/or hard-of hearing's responses

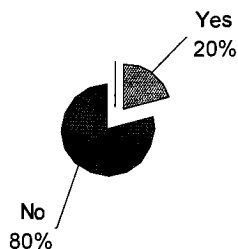


Hearing's responses

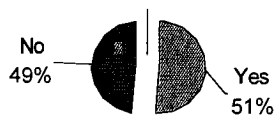


2. Colleagues find electronic white boards important:

Deaf and/or hard-of hearing's responses

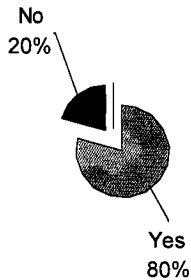


Hearing's responses

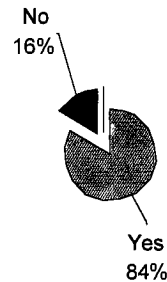


2. Colleagues find instant messaging important:

Deaf and/or hard-of hearing's responses



Hearing's responses



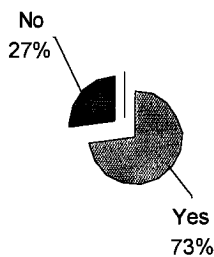
Both deaf and/or hard-of-hearing and hearing colleagues felt that e-mail and instant messaging were the most important tools, although they stated that the technology would need to improve significantly before it would add any real benefit to the rest of the tools. With the technologies that introduced, it can be difficult to predict success or failure.

From these findings, it appears that people were not completely confident in synchronous communication tools technology other than e-mail and instant messaging. It may take time before we see the widespread use of synchronous communication tools.

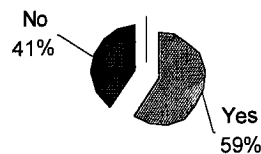
Question 3, 4 and 5: The next three questions address people's perceived levels of confidence, abilities and skills.

3. Colleagues have increased their confidence in online communication by using synchronous communication tools:

Deaf and/or hard-of hearing's responses

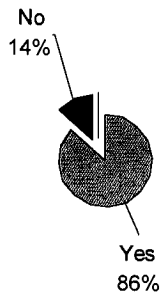


Hearing's responses

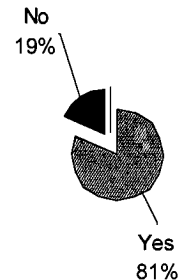


4. Colleagues have increased their abilities to communicate with colleagues by using synchronous communication tools:

Deaf and/or hard-of hearing's responses

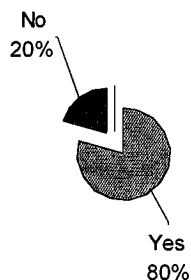


Hearing's responses

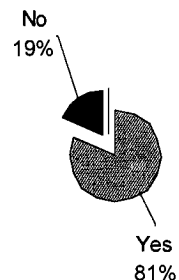


5. Colleagues have improved their communication skills by using synchronous communication tools technology:

Deaf and/or hard-of hearing's responses



Hearing's responses



Well over 50% of both respondent groups felt that they were confident and had increased their abilities and improved their communication with each other by using synchronous communication tools. According to the survey, most deaf and/or hard-of-hearing colleagues felt that the advantage of these tools:

Deaf and/or hard-of-hearing

- Hide deaf and/or hard-of-hearing's identity
- Decrease need for interpreters
- Allow direct communication instead of third party

Hearing

- Are more cost effective than the telephone
- Are great for coordinating meetings and daily tasks
- Increase speed of communication

Both

- Are less reliance on telephone use
- Are easier than TTY and voice answering machines

Deaf and/or hard-of-hearing

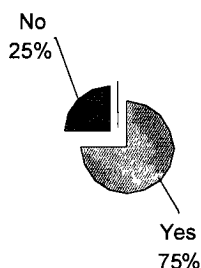
- Overcome of communication barrier created with hearing people

Hearing

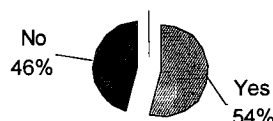
- Provide instant gratification, contact, and a feeling of accomplishment

Question 6: The percentages showing that synchronous communication tools have enabled hearing colleagues to increase their independence:

Deaf and/or hard-of hearing's responses



Hearing's responses



Synchronous communication tools seemed to have enabled both colleague groups to increase their independence. Advantages of synchronous communication tools cited by respondents are:

Deaf and/or hard-of-hearing

- Express themselves firsthand and freely.
- Get the opportunity to practice writing skills.
- Talk directly to each other rather than depending on interpreters or relay services.
- Not worry about responding to a comment or question that they misheard or misunderstood.
- Show them that deaf and/or hard-of-hearing people are able to communicate with hearing people.

Hearing

- Both communicate and clearly understand each other.
- When using synchronous communication tools, everybody's the same.
- Easier than TTY and certainly much easier and more private than Relay.
- Limited to writing notes which is a slow process, and ability to communicate faster and more completely when typing.
- Not proficient in sign, the ability to use a common tool speeds ability to communicate and be accurate in that communication.

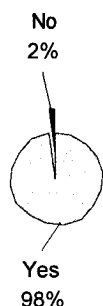
Both

- Less chance for ambiguity or confusion.
- Fast, easy and less chance of misunderstanding.
- Ease and efficacy.

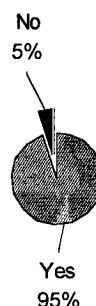
Question 7 and 8: This part focused on perceived levels of comfort concerning the difference of writing styles that people use.

7. Colleagues are comfortable conversing in English with colleagues at work:

Deaf and/or hard-of hearing's responses

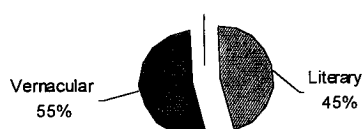


Hearing's responses

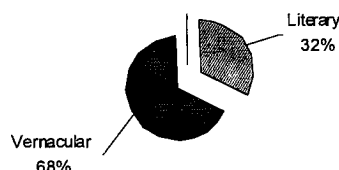


8. The percentages showing that colleagues use chat or instant messaging, they type their text in...

Deaf and/or hard-of hearing's responses



Hearing's responses



More than 90% of both groups were comfortable conversing in English with each other at work. Most of them would prefer to use vernacular English when they are typing for chatting or instant messaging.

The reasons why most of them would rather use vernacular English than literary English included:

Both

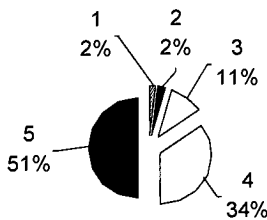
- Simple and short
- Comfortable with conversational style of speech
- For those people who are fast typists, would for speed rather than accuracy

Both

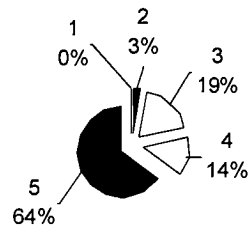
- Consider the level of English when sending to deaf and/or hard-of-hearing individuals or any second language users.

Question 9: The percentages showing the rate of effectiveness in communicating with colleagues measured on a scale from 1 to 5:

Deaf and/or hard-of hearing's responses



Hearing's responses



Just over 50% of deaf and/or hard-of-hearing survey respondents and just over 60% of hearing population felt very effective in communicating with each other. According to the interviews, all interviewed found themselves very effective in communicating with each other.

Question 10: What obstacles (problems) may be related to the use of the synchronous communication tools?

Interviews and survey respondents cited a number of obstacles:

Deaf and/or hard-of-hearing

- The major problem is lacking the social aspect - not being there face to face.
- Sometimes some hearing folks don't pick up the humor or "tone" of what people try to convey.
- Technology is not good because sometimes it is not accurate. They do not trust technology 100 percent yet.

Hearing

- Misinterpretation of written text.
- Misunderstanding due to unseen facial expressions.
- Some people can't type as fast as they can communicate verbally.

Both

- IM is not "on."
- When server is down.
- Lack of knowledge on how to use the tools; lack of participation or interest in trying new technology.

Deaf and/or hard-of-hearing

- There are some people who are not tech savvy so they get uncomfortable trying to communicate with each other.
- Most of them are not used to people's ways of using NetMeeting, they close it and get them frustrated contacting them.
- Sometimes the colleagues did not read the whole e-message and emailed me for more information. No problems with instant messaging.
- Hearing may judge people's intellectual ability writing skills thus they wouldn't want to be penalized or it could reflect on their performance.

Hearing

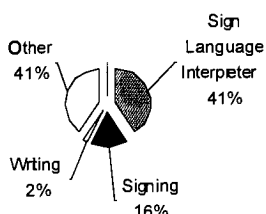
- Sometimes have to be very careful not to misinterpret intent or emotion because it is not face-to-face.
- Miss the personal interaction with the individual. It also decreases the practice of sign language with deaf individuals.
- Sometimes the technology does not work, also you need a presence indicator, and also some way to make chat persistent.
- Often online researching and IM can interrupt people at any time and they will feel obligated to respond when people might not take a TTY or voice call because they would be busy. With IM, will feel rude if they do not respond to the message immediately.

Both

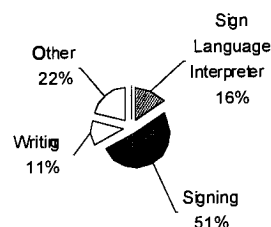
- Instant messaging lack the meaning implied by verbal tone. Also facial expressions and body language are missing. Using emoticons (smiley faces, etc.) helps some.

Question 11: The method that colleagues would prefer to use when communicating with colleagues:

Deaf and/or hard-of hearing's responses



Hearing's responses

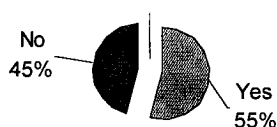


If they had to choose a method of communication, the deaf and/or hard-of-hearing would prefer to have an interpreter. It is the same percent with "other"

category, who would prefer to use instant messaging or e-mail. As for hearing people they would prefer using signing to deaf and/or hard-of-hearing people. For "other" on hearing respondents' survey, most of them preferred instant messaging or talking in person.

Question 12: Is overall usage of synchronous communication designed for hearing users felt by deaf and/or hard-of-hearing colleague users?

Deaf and/or hard-of hearing's responses



Slightly more than half of the deaf and/or hard-of-hearing colleagues' users felt that synchronous communication tools were designed specifically for hearing people.

Question 12: Do hearing colleagues consider deaf and/or hard-of-hearing colleagues less intelligent whose English appear to be faulty?

Hearing's responses



All respondents were aware that most deaf and/or hard-of-hearing's English is considered a second language and that they couldn't help having weak English.

Most hearing people were willing to write in vernacular English to prevent from misunderstanding. Over the past 30 years, more hearing people have become aware of deafness, as was stated by Willis Mann when I had an interview with him.

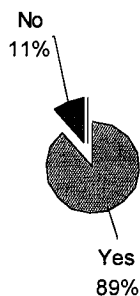
Question 13: What kind of synchronous communication tools software/products do you use at work?

The tools reported include:

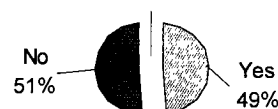
<u>Deaf and/or hard-of-hearing</u>	<u>Hearing</u>	<u>Both</u>
<ul style="list-style-type: none"> • MS Mail • Ms Outlook • NetWare Services • Yahoo Messenger 	<ul style="list-style-type: none"> • Webex • Placeware • Lotus QuickPlace 	<ul style="list-style-type: none"> • ICQ • NetMeeting • Lotus Notes • AOL Instant messenger • Lotus Sametime Connect (instant messaging)

Question 14: Colleagues using assistive technology on a regular basis:

Deaf and/or hard-of hearing's responses



Hearing's responses



Most colleagues were still using assistive technology because synchronous communication tools are not everywhere at this point. Most people had TTY in their workplace to make phone calls to communicate with each other. A lot of deaf and/or hard-of-hearing people were using two-way pagers as a part of their communication.

There were ten questions in the Demographic Information category. The users were asked the usual demographic questions regarding age, gender,

geographical location, occupation, race, level of education, impairments, etc., as well as questions regarding frequency of synchronous communication tools use. Standard in all questionnaires was the inclusion of a text-entry comment box if they selected "other."

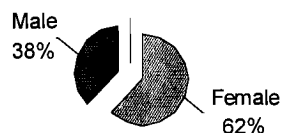
Demographic Information

Question 15: The percentages identify colleagues as:

Deaf and/or hard-of hearing's responses

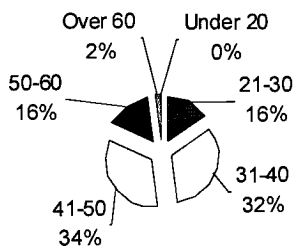


Hearing's responses

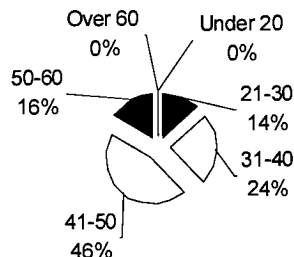


Question 16: The percentages showing that colleagues fall in these age ranges:

Deaf and/or hard-of hearing's responses



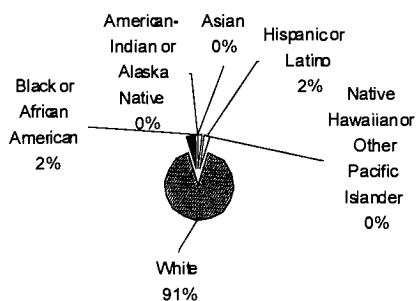
Hearing's responses



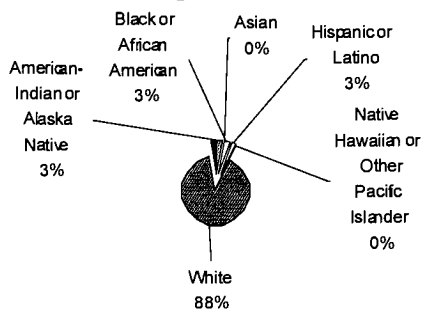
I suspect these results reflected the relative inaccessibility of synchronous communication tools for people younger than 30 years old.

Question 17: The percentages showing that colleagues identify themselves as:

Deaf and/or hard-of hearing's responses

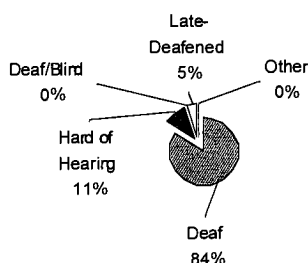


Hearing's responses



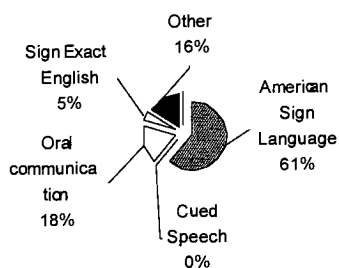
Question 18: The percentages showing that deaf and/or hard-of hearing colleagues identify themselves as:

Deaf and/or hard-of hearing's responses

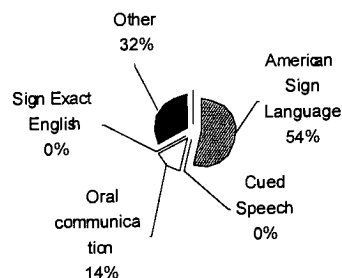


Question 19: The percentages identifying methods of communication are:

Deaf and/or hard-of hearing's responses

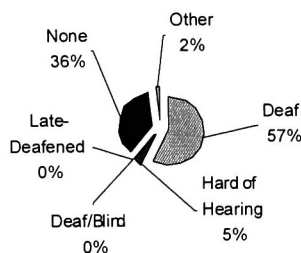


Hearing's responses

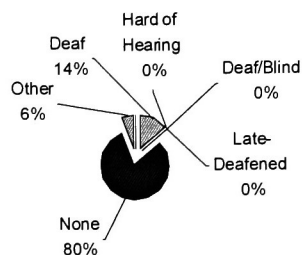


Question 20: The percentages showing that colleagues' family members are:

Deaf and/or hard-of hearing's responses

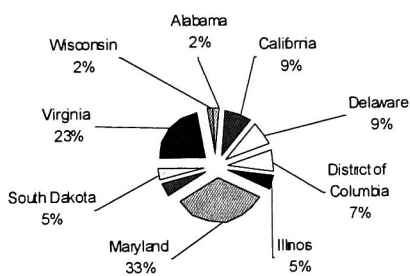


Hearing's responses

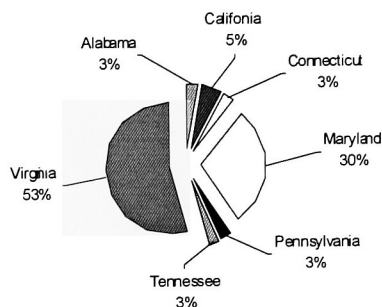


Question 21: States that they live in:

Deaf and/or hard-of hearing's responses

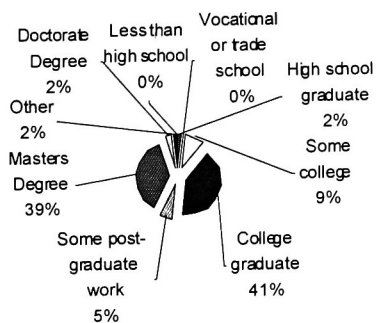


Hearing's responses

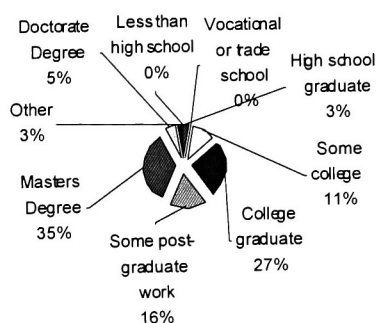


Question 22: The percentages showing the highest education level that colleagues have completed:

Deaf and/or hard-of hearing's responses

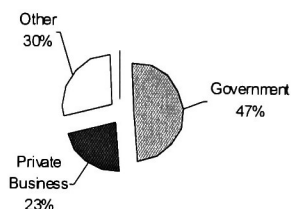


Hearing's responses

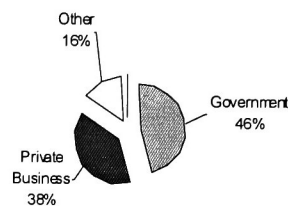


Question 23: The percentages showing that deaf and/or hard-of-hearing colleagues are employed in:

Deaf and/or hard-of hearing's responses

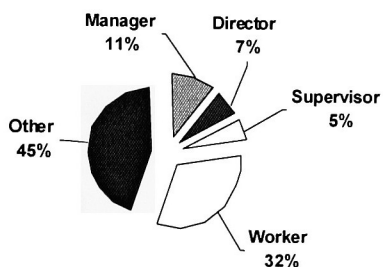


Hearing's responses

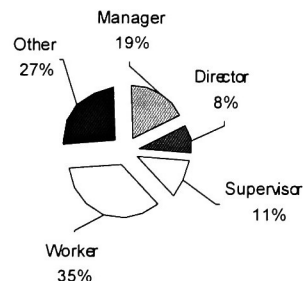


Question 24: The percentages showing that deaf and/or hard-of-hearing colleagues are employed in:

Deaf and/or hard-of hearing's responses



Hearing's responses



Recommended Directions for Future Research

I hypothesized that, in general, synchronous communication tools in the workplace, are more important to the deaf and/or hard-of-hearing people to mainstream them with hearing people. More hearing people are being exposed to deaf and/or hard-of-hearing people's culture. For example, a lot of workplace offices have an Equal Employment Office (EEO), and when their new deaf and/or hard-of-hearing employees join in the office, they usually tend to give a workshop on deafness to educate employees about deaf and/or hard-of-hearing's culture. Most hearing people do not consider that deaf and/or hard-of-hearing people's English is faulty due to their lack of hearing. According to the survey, hearing

people stated that they would prefer to use vernacular English to prevent misunderstanding, and to go for speed rather than accuracy because time is more important than precision in the workplace. Hearing colleagues have shown that they have increased confidence in online communications by using synchronous communication tools. It is the same for deaf and/or hard-of-hearing colleagues: they feel comfortable conversing in English with hearing colleagues in the workplace. Deaf and hard-of-hearing people felt that they have improved their communication skills by using synchronous communication tools. Therefore, the use of synchronous communication tools appears to facilitate interaction between deaf or/and hard-of-hearing colleagues and hearing colleagues and the positive attitudes toward collaboration on the Internet have already improved dramatically. But the use of these tools is still new because not every workplace has synchronous communication tools. The more positive deaf or/and hard-of-hearing and hearing colleagues' attitudes toward collaboration are, the greater the increase in people's individual and collective benefits from these tools is likely to be. Future research can confirm this.

Observations

One of the purposes of this research was to gather concepts and data with which to suggest possible directions for additional research of uses of new communication technologies. This part of the thesis discusses the implications of the research conducted for this thesis. At the same time it attempts to suggest the beginnings of such a work by drawing on concepts of collective and collaborative use, and the data gathered in the comments, interviews and survey. These suggestions for a work will hopefully be helpful for future studies of synchronous communication tools use and implications.

Perhaps the most distinguishing characteristic of synchronous communication tools, and fundamental to the understanding of their use, is the accessibility and sometimes almost simultaneous influence of multiple text-based environments. Most members of the survey group, for example, reported using no more than

ten hours to use of the synchronous communication tools in the workplace. After all, almost all people who go online use both email and the Web, according to a report from Graphics, Visualization, & Usability Center (1997a). In the same way, almost all people will start to use them in the workplace incrementally. This is particularly true since many probably use more than one technology during each "sitting" or session at a networked computer.

For Internet use, mediation of texts can take place in both the local environment of use and in the social environments of cyberspace. Dialogue in chat rooms, discussion forums, and e-mail can mediate interpretations of texts accessed through various Internet technologies. All of the survey respondents who viewed the synchronous communication tools as a significant source of information also reported that they communicated with deaf and/or hard-of-hearing and hearing colleagues through e-mail and other technologies. Furthermore, simultaneous usage of synchronous communication tools technologies is possible and can greatly influence the mediation of texts. For example, synchronous communication tools are an increasingly common phenomena on the Internet. Synchronous communication tools are organized and designed for any number of purposes and often entail a live presentation, such as multicast video broadcast of a meeting or text sent out over the Internet, along with chat rooms and discussion forums set up for the participation of Internet users.

Members of virtual communities do engage in types of social uses such as maintenance of a collective shared with other members of virtual communities. The survey results show the communication between the deaf and/or hard of hearing and hearing people for the purpose of sharing personal experiences and ideas has been a valuable use of synchronous communication tools for most of the respondents. These types of "social uses" might be somewhat different from how this term has been defined in the study of other tools. The various types of social uses of new, networked information and communication technologies need to be analyzed, defined and understood through future research.

The results show that some who use networked information and synchronous communication tools technologies will be enthusiastic and engaged in the vast potential for expression, representation and different types of communication available. Some other users are strongly resistant to using synchronous communication tools. It is important to note, however, that it would be ideal to pursue further study of attitudes toward synchronous communication tools.

Although most uses of networked technologies are part of processes and exchange, the influences of synchronous communication tools use probably varies greatly. A few of the survey respondents, for example, did not feel that synchronous communication tools use was really that important for communication and interaction between the deaf and/or hard-of-hearing and hearing. Many of these respondents are co-workers, friends, and supervisors who use e-mail or Internet access. While the most exciting projects making use of synchronous communication tools applications on the Internet are the work of enthusiasts, I must also focus on those who only connect once or twice a week, and whether these users participate in communication (and how and why they do so). Thus, by understanding the uses of synchronous communication tools, one should recognize and seek to explore a wide range of social and individual uses.

This question reiterates the need for a work to recognize and seek to better understand the interaction between virtual and real-world practices and environments. Studies with multiple research methods are needed to get at different uses and socialization in synchronous communication tools that are driven, while positing how virtual decoding impacts these people in the workplace. A work for understanding uses of the Internet must also seek to understand how long-term uses of synchronous communication tools affect processes of observation and socialization. This is particularly true for children who are growing up using synchronous communication tools. The diversity, range of viewpoints and communication options available can certainly be seen as threatening, such as writing in English because it is deaf and/or hard-of-hearing people's second language. Will the networked generations of the near

future build a strong foundation through Internet use the same way some of us did/do with synchronous communication tools? How does Internet use and the proliferation of online and virtual communities' challenge the power of synchronous communication tools?

Many enterprises will ultimately require high-quality desktop conferencing tools that will be as basic as shared whiteboards or shared application functionality. Such lower-bandwidth collaborative solutions support improved technical collaboration, introduce users to the desktop conferencing paradigm, and can provide a seamless migration path to fuller conferencing capabilities when required. As a result, private industry and government offices are as an enhancing technology, providing basic functionality are embracing collaborative computing. The users can begin by implementing entry-level capabilities, take advantage of collaborative tools without impacting network performance, and still be able to upgrade clients on the LAN as needed.

However, e-mail is still the most powerful tool in the workplace at this time. Forty percent of the American workforce uses e-mail (Dickerson, 1997). Even though it is an asynchronous communication tool, it is a bridge of synchronous communication tools. In 1994, 776 billion e-mail messages moved through U.S. based computer networks. In 1997, that number tripled to 2.6 trillion messages. By 2001, the number already increased nearly triple again to 6.6 trillion among the expected 108 million e-mail users. According to the U.S. Postal Service (USPS), nearly 40% of business and personal correspondence already bypasses the USPS by traveling over the Internet. Many users of e-mail consider this method more effective than faxing, voice mail, telephone, regular mail, synchronous communication tools and personal meetings (Marken, 1998). And the practice of including e-mail addresses on business cards (which indicate the current socioeconomic status of the person) is commonplace. (Lumsden 1997)

Another reason why e-mail is still the most powerful tool is because almost every workplace is allowed to use e-mail at anytime as long as it is related to work.

Some workplaces are not allowed to use any kind of synchronous communication tool in the workplace due to security reasons. Synchronous communication tools are still new and most of private industry and government is studying synchronous communication tools to see if they are worthwhile the workplace.

The results of the survey have shown that communication, group networking and reproduction are some of the most significant uses of synchronous communication tools. All of the survey respondents are participants in a virtual community of deaf and/or hard-of-hearing colleagues. They have sought out communication with each other because they (in different ways) value these interactions. The research conducted for this thesis has offered a limited understanding of how uses of synchronous communication tools are connected. It has examined what the differences between text-based environment possible for synchronous communication tools and those common with Internet consumption might imply for the future effects of use on synchronous communication tools. Additional research in this area should focus on more tools because most offices with networking don't have the capabilities to use fast bandwidth or high technologies such as application sharing, electronic meeting, and electronic whiteboards.

Additional final area that this thesis has neglected is the architecture, hardware, software and security that make synchronous communication tools possible. The development of these synchronous communication tools is driven by corporate telecommunications and computer industries. Future research must assess how this influences the uses synchronous communication tools that people engage via the Internet or Intranet, and prove that synchronous communication tools can help communications between deaf and/or hard-of-hearing people in the workplace.

What is available in the future is a new type transistor. This ballistic transistor switches 1000 times faster than the transistors used in today's communication

switches and microcomputers. The fastest bipolar transistor switches on and off 140 billion times a second.

Superconductors will have a major impact on future data communication circuits. Experiments have shown that superconductors can transmit data at extremely high rates and have the potential to become the building blocks for new generation of faster communications. Superconductors are materials that conduct electronically without resistance at extremely low temperatures. Based on an assumption that the temperature at which a material becomes a superconductor can continue to be raised, experiments have proven that superconductors will have the ability to transmit up to 100 times faster than optical fibers.

It was only 15 years ago that we were first able to transmit at a speed of 9600 bits per second (bps) on a standard telephone circuit. Using various digital technologies, we now can transmit at 64,000 bits per second on the same telephone circuit, and with the use of fiber optics we can transmit at several hundred million bits per second. In the future, we will transmit at billions of bits per second with fiber optics. (Dennis and Fitzgerald, 1996) The impact on future collaborative capabilities is likely to be great.

In the future, we will see more synchronous communication tools in the workplace with the technologies available.

Lastly, there is an observation about the limitations of thesis research that I would like to mention. The interviews and survey themselves were in some ways very successful, since many interesting and useful responses were gathered. Yet, considering that this thesis focused on issues, I think that more information on each respondent's background, world-view and specific uses of synchronous communication tools would have enabled me to answer the research questions more thoroughly. Overall, however, this study should be helpful for preliminary understanding of how and why individuals use networked communication

technologies. The information gathered can be utilized for future research of Internet uses and compliance with the Telecommunication Act or any other laws for communication access for disabled people (specifically for deaf and/or hard-of-hearing). Synchronous communication tools are and will be very important for communication between deaf and/or hard-of-hearing colleagues and hearing colleagues in the workplace.

Conclusions

In conclusion, it can be said that synchronous communication tools have a long way to go before they will meet a majority of users' expectations. Most people surveyed felt that synchronous communication tools did point the way to the future. Some, having witnessed the relative overnight success of synchronous communication tools, hold the widely accepted belief that, given time, synchronous communication tools will improve. Synchronous communication tools are currently largely targeted on the workplace.

In general, deaf and/or hard-of-hearing and hearing people are major synchronous communication tool users at home, which goes towards explaining their popularity in the workplace. For instance, greater usage the tools at home builds the familiarity and may create expectations and desire to have similar functionality at work.

Some workplaces have just unveiled synchronous communication tools to interact between deaf and/or hard-of-hearing and hearing colleagues as part of "communication access." If current trends continue, synchronous communication tools are going to be a thing of the future in the workplace, providing communication to deaf and/or hard-of-hearing and hearing colleagues who for business reasons are on the move a lot.

A good example is a deaf lady, Jamie Berke, a deaf web designer from Northern Virginia, who made this comment:

Instant Messaging allows me to discuss assignments and technical challenges with my co-workers and supervisor. It also provides a way to be included in things like office politics and office humor. If something is happening, all a co-worker has to do is quickly send me an instant message. Plus, instant messaging allows me to have "conversations" with co-worker. I can't "yell" across the room to someone, but instant messaging allows me to "yell" in a way. There's just one thing- some of my co-workers commented that they needed sign language classes to communicate with me, and I replied, jokingly, "Forget sign language classes. What you guys need is typing classes!"

"The rapid advances in technology have created an entirely new lifestyle, and nowhere is it more apparent than in the deaf community." (Bryd, 2000)

Bibliography

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Appendix A - Survey

Figure 1: A sample introduction letter to the survey for deaf and/or hard-of-hearing employees.

March 4, 2001

To Whom It May Concern:

I would like to introduce myself: my name is Yael Agriss. I live in the Washington, D.C. area. For the past year, I have worked for the Central Intelligence Agency as a computer systems analyst. I have a Bachelor's Degree in Communication Arts from Gallaudet University in May 1993. Then I enrolled in the Rochester Institute of Technology in the spring of 1997 for the Masters program in Information Technology. Right now, I am working on my thesis so I can get my Master's degree this May. My concentration is in Networking and Interactive Multimedia Development.

The focus of my thesis is synchronous communication tools. This research will help me understand how many deaf and/or hard-of-hearing and hearing employees in the workplace have used synchronous communication tools. I am defining synchronous communication tools as software used to help people who are not co-located to work together at the same time (e.g., instant messaging, chat/IRC [Internet Relay Chat], electronic white boards and electronic meeting room). I would like to see if their communication is more effective when they are using this technology.

The reason I am writing this letter is because one of my colleagues recommended your name. I would like to know if you are willing to complete the survey for my research. There are only 24 questions. The survey can be done on the Internet. I am looking for qualified employees who are using the Internet at their workplaces to see if they are using synchronous communication tools. The hearing employees must have at least some experience in communicating with deaf and/or hard-of-hearing and hearing colleagues in their workplace in order to be participants in my research.

Please feel free to take a look at my website. The URL address is <http://www.rit.edu/~yda0721/>. I also would like for you to complete the survey via the website. It should not take more than 5 to 10 minutes to do the survey. I would appreciate your participation in my vital research. Please complete the survey by April 15th in order for me to collect the data for my statistical information.

If you know of anyone who is qualified to participate in this project, please send or forward this letter. This can be shared with your hearing colleagues. Your

help will be greatly appreciated. I thank you in advance for taking the time to participate in the survey.

Sincerely,

Yael D. Agriss

Figure 2: A sample introduction letter to the survey for hearing employees.

March 4, 2001

To Whom It May Concern:

I would like to introduce myself: my name is Yael Agriss. I live in the Washington, D.C. area. For the past year, I have worked for the Central Intelligence Agency as a computer systems analyst. I have a Bachelor's Degree in Communication Arts from Gallaudet University in May 1993. Then I enrolled in the Rochester Institute of Technology in the spring of 1997 for the Masters program in Information Technology. Right now, I am working on my thesis so I can get my Master's degree this May. My concentration is in Networking and Interactive Multimedia Development.

The focus of my thesis is synchronous communication tools. This research will help me understand how many deaf and/or hard-of-hearing and hearing employees in the workplace have used synchronous communication tools. I am defining synchronous communication tools as software used to help people who are not co-located, while working together at the same time. (e.g., instant messaging, chat/IRC [Internet Relay Chat], electronic white boards and electronic meeting room). I would like to see if their communication is more effective when they are using this technology.

The reason I am writing this letter is because one of my colleagues recommended your name. I would like to know if you are willing to participate in the survey for my research. There are only 23 questions. The survey can be done on the Internet. I am looking for qualified employees who are using the Internet at their workplace to see if they are using synchronous communication tools. The hearing employees must have at least some experience in communicating with deaf and/or hard-of-hearing in their workplace in order to be participants in my research.

Please feel free to take a look at my website. The URL address is <http://www.rit.edu/~yda0721/>. I also would like for you to complete the survey via the website. It should not take more than 5 to 10 minutes to do the survey. I would appreciate it if you are willing to participate in my vital research. Please

complete the survey by April 15th in order for me to collect the data for my statistical information.

If you know of anyone who is qualified to participate in this project, please send or forward this letter. This can be shared with your deaf and/or hard-of-hearing and hearing colleagues. Your help will be greatly appreciated. I thank you in advance for taking the time to participate in the survey.

Sincerely,

Yael D. Agriss

Figure 3: A sample of survey for deaf and/or hard-of-hearing people.

1. How many hours do you spend using synchronous communication tools per week?

☐ 0-10

☐ 11-20

☐ 21-30

☐ 31-40

☐ 41+

☐ If you don't use synchronous communication tools, please explain why. _____

2. Below are the basic capabilities of synchronous communication tools. Of these capabilities, which one do you consider to be the most important?

Application sharing	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Chat/IRC (Internet Relay Chat)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Electronic mail (asynchronous)	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Electronic meeting room	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Electronic white boards	<input type="checkbox"/> Yes	<input type="checkbox"/> No
Instant Messaging	<input type="checkbox"/> Yes	<input type="checkbox"/> No

3. Has using synchronous communication tools increased your confidence in using online communications?

☐ Yes

☐ No

Explain how. _____

4. Has using synchronous communication tools increased your ability to communicate with hearing colleagues?

☐ Yes

☐ No

Explain how. _____

5. Do you feel that using synchronous communication tools improve your communication skills using technology?

☐ Yes

☐ No

6. Have synchronous communication tools allowed you to increase your confidence when communicating with hearing colleagues?

☐ Yes

☐ No

Explain how. _____

7. Do you feel comfortable conversing in written English with hearing colleagues?

☐ Yes

☐ No

8. When you are using chat or instant messaging, do you type your text in literary (formal English) or vernacular (informal English)?

☐ Literary
☐ Vernacular

9. How would you rate the effectiveness of communication and interaction with deaf and/or hard-of-hearing colleagues using synchronous communication tools?

Scale

Poor ←————→ Good

☐ 1 ☐ 2 ☐ 3 ☐ 4 ☐ 5

10. What obstacles (problems) may be related to the use of the synchronous communication tools?

Please explain here: _____

11. Which communication mode do you prefer when communicating with hearing colleagues?

☐ A sign language Interpreter
☐ Signing
☐ Writing
☐ Others: _____

12. Do you feel that overall usage of synchronous communication tools is designed for hearing users?

☐ Yes
☐ No

13. What kind of synchronous communication tools software/products do you use everyday at work?

Please explain here: _____

14. Do you use any assistive technology devices on a regular basis? (e.g., TTY, Phone with amplifier and braille)

☐ Yes

☐ No

If so, what are the devices: _____

Demographic Information

15. What is your gender?

☐ Female

☐ Male

16. What is your age?

☐ Under 20

☐ 21-30

☐ 31-40

☐ 41-50

☐ 51-60

☐ Over 61

17. With which race/ethnicity do you identify?

☐ American Indian or Alaska Native

☐ Asian

☐ Black or African American

☐ Native Hawaiian or Other Pacific Islander

☐ White

☐ Other: _____

18. Do you consider yourself:

☐ Deaf

☐ Hard of Hearing

☐ Deaf/Blind

☐ Late-Deafened

☐ Other: _____

19. Which communication method do you use daily?

☐ American Sign Language

☐ Cued Speech

☐ Oral Communication

☐ Sign Exact English

☐ Writing

☐ Other: _____

20. Do your family members have any of the following long-lasting conditions?

☐ Deaf and/or hard-of-hearing

☐ Hard of Hearing

☐ Deaf/Blind

☐ Late-Deafened

☐ None

☐ Other: _____

21. In what state do you live? (a scroll down with a list of 50 states)

22. What is the highest level of education you have completed?

- ☐ Less than high school
- ☐ High school graduate
- ☐ Vocational or trade school
- ☐ College graduate
- ☐ Some post-graduate work
- ☐ Masters Degree
- ☐ Doctorate Degree
- ☐ Other: _____

23. Are you employed with:

- ☐ Government
- ☐ Private business
- ☐ Other: _____

24. Please state your position:

- ☐ Manager
- ☐ Director
- ☐ Supervisor
- ☐ Worker
- ☐ Other: _____

Figure 4: A sample of survey for hearing people.

1. How many hours do you spend using synchronous communication tools per week?

☐ 0-10

☐ 11-20

☐ 21-30

☐ 31-40

☐ 41+

☐ If you don't use synchronous communication tools, please explain why. _____

2. Below are the basic capabilities of synchronous communication tools. Of these capabilities, which one do you consider to be the most important?

Application sharing

☐ Yes

☐ No

Chat/IRC (Internet Relay Chat)

☐ Yes

☐ No

Electronic mail (asynchronous)

☐ Yes

☐ No

Electronic meeting room

☐ Yes

☐ No

Electronic white boards

☐ Yes

☐ No

Instant Messaging

☐ Yes

☐ No

3. Has using synchronous communication tools increased your confidence in using online communications?

☐ Yes

☐ No

Explain how. _____

4. Has using synchronous communication tools increased your ability to communicate with deaf and/or hard-of-hearing colleagues?

☐ Yes

☐ No

Explain how. _____

5. Do you feel that using synchronous communication tools improve your communication skills using technology?

☐ Yes

☐ No

Explain how. _____

6. Have synchronous communication tools allowed you to increase your confidence when communicating with deaf and/or hard-of-hearing colleagues?

☐ Yes

☐ No

Explain how. _____

7. Do you feel comfortable conversing in English with deaf and/or hard-of-hearing colleagues?

☐ Yes

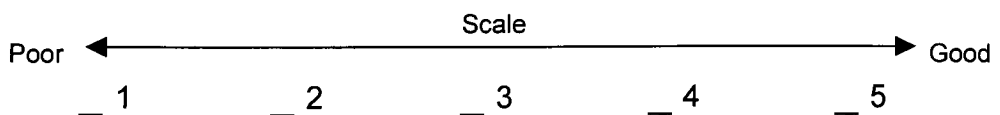
☐ No

8. When you are using chat or instant messaging, do you type your text in literary (formal English) or vernacular (informal English)?

☐ Literary

☐ Vernacular

9. How would you rate the effectiveness of communication and interaction with deaf and/or hard-of-hearing colleagues using synchronous communication tools?



10. What obstacles (problems) may be related to the use of synchronous communication tools?

Please explain here: _____

11. Which communication mode do you prefer when communicating with deaf and/or hard-of-hearing colleagues?

☐ A sign language Interpreter

☐ Signing

☐ Writing

☐ Others: _____

12. If the deaf and/or hard-of-hearing colleagues' English appear to be faulty, would you consider them less intelligent?

☐ Yes

☐ No

13. What kind of synchronous communication tools software/product do you use at work?

Please explain here: _____

14. Do you use any assistive technology devices on a regular basis? (e.g., TTY, Phone with amplifier and braille)

☐ Yes

☐ No

If so, what are the devices: _____

Demographic Information

15. What is your gender?

☐ Female

☐ Male

16. What is your age?

- ☐ Under 20
- ☐ 21-30
- ☐ 31-40
- ☐ 41-50
- ☐ 51-60
- ☐ Over 61

17. With which race/ethnicity group do you identify?

- ☐ American Indian or Alaska Native
- ☐ Asian
- ☐ Black or African American
- ☐ Native Hawaiian or Other Pacific Islander
- ☐ White
- ☐ Other: _____

18. Which communication mode do you use when communicating with deaf and/or hard-of-hearing people?

- ☐ American Sign Language
- ☐ Cued Speech
- ☐ Oral
- ☐ Sign Exact English
- ☐ Other: Please specify: _____

19. Do your family members have any of the following long-lasting conditions?

- ☐ Deaf and/or hard-of-hearing
- ☐ Hard of Hearing
- ☐ Deaf/Blind
- ☐ Late-Deafened
- ☐ None
- ☐ Other: _____

20. What is the highest level of education you completed?

- ☐ Less than high school
- ☐ High school graduate
- ☐ Vocational or trade school
- ☐ College graduate
- ☐ Some post-graduate work
- ☐ Masters Degree
- ☐ Doctorate Degree
- ☐ Other: _____

21. In what state do you live? (a scroll down with a list of 50 states)

22. Are you employed with:

- ☐ Government
- ☐ Private business
- ☐ Other: _____

23. Please state your position:

- ☐ Manager
- ☐ Director
- ☐ Supervisor
- ☐ Worker
- ☐ Other: _____

Appendix B - Interview

Figure 1: a sample introduction letter for an interview.

March 4, 2001

Dear [Click [here](#) and type name]:

I would like to introduce myself: my name is Yael Agriss. I live in the Washington, D.C. area. For the past year, I have worked for the Central Intelligence Agency as a computer systems analyst. I have a Bachelor's Degree in Communication Arts from Gallaudet University in May 1993. Then I enrolled in the Rochester Institute of Technology in the spring of 1997 for the Masters program in Information Technology. Right now, I am working on my thesis so I can get my Master's degree this May. My concentration is in Networking and Interactive Multimedia Development.

The focus of my thesis is synchronous communication tools. This research will help me understand how many deaf and/or hard-of-hearing and hearing employees in the workplace have used synchronous communication tools. I am defining synchronous communication tools as software used to enable people who are not co-located to work together at the same time (e.g., instant messaging, chat/IRC [Internet Relay Chat], electronic white boards and electronic meeting room). I would like to see if their communication is more effective when they are using this technology.

The reason I am writing this letter is because one of my colleagues recommended your name. I would like to know if I could set up an interview with you for research purposes. There are only 22 questions. The interview can be done in person or via Instant Messaging if you have that capability at work or home. I am looking for qualified employees who are using the Internet at their workplaces to see if they are using synchronous communication tools. The hearing employees must have at least some experience in communicating with deaf and/or hard-of-hearing and hearing colleagues in their workplace in order to be participants in my research.

If you feel that you are qualified for and would like to participate in an interview, please send me an e-mail at yda0721@grace.rit.edu and set up a date that is convenient for you. Thank you in advance for taking time to read my letter. I also would like to do the interview before March 30th if possible.

Please feel free to take a look at my website. The URL address is <http://www.rit.edu/~yda0721/>. I also would like for you to do the survey via the website since the interview will be a bit different from the questionnaire in the survey. It should not take more than 5 to 10 minutes to do the survey. If you

know anyone who is qualified to complete the questionnaire and would like to participate in the survey, please send or forward this letter. Your help will be greatly appreciated. Please complete the survey by April 15th in order for me to collect the data for my statistical information.

Sincerely,

Yael D. Agriss

Figure 2: Transcripts of deaf and/or hard-of hearing government employees' interviews.

Interview with Alicia Epstein in person on 3/8/01.

1. What is your name?

Her name is Alicia Epstein with Department of Labor.

2. How long have you been working for this company or agency?

She has been working for this agency for 8 months.

3. Is your company government or private?

She works for the government.

4. What is your position?

She is a program manager.

5. What is your primary mode of communication?

Her primary language is American Sign Language.

6. What kind of synchronous communication tools software/products do you use everyday at work?

She uses Outlook 2000 express e-mail program. She sometime uses American Online Instant Messaging.

7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

She is still using e-mail and instant messaging but not related to work.

8. How often do you use synchronous communication tools?

There are about 50 e-mails per day and she checks her e-mail pretty often. She uses IM about 3 times a week.

9. Any positive aspects in using these tools?

She feels that the tools provide accessibility for deaf and/or hard-of-hearing people. It is easily better than other communication like interpreters because interpreters can misinterpret while typing in English is straightforward.

10. Any negative aspects in using these tools?

She has to look at the screen all the time, unlike face-to-face communication.

11. Is privacy a concern? Why or why not?

She is not concerned about privacy at all.

12. How do you deal with receiving unwanted material such as spam, e-mail, chat requests or offensive images and text?

If she sees a subject line that she does not know about it or an odd name then she will delete them.

13. How do you deal with distraction?

She does not feel any distraction because she is used to it.

14. Do you think you have become addicted to using these tools? Why?

Yes, if they decided to remove the synchronous communication tools at her workplace, she would feel she was going back to the Dark Ages.

15. Have synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Yes, she is confident and has accessibility to hearing people.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Definitely. She does not need to schedule an interpreter.

- 17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

When she uses e-mail, she will use literary. If she uses IM, she will use vernacular.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing colleagues? How?**

Yes, she feels that it puts her on the same level as hearing people. She is able to contribute her ideas and can participate in the meeting.

- 19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?**

She rates her overall level of independence at 100%.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?**

She feels that it will have a big impact on a lot of deaf and/or hard-of-hearing people in the future. Might see some of them move up to the front line.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

She would like to see more cameras in the workplace so she can see other people's faces.

Interview with Mark McKay via Instant Messaging on 3/26/01.

- 1. What is your name?**

My name is Mark G. McKay and I work for U.S. Department of Education.

- 2. How long have you been working for this company or agency?**

I have been working for this agency since April 1999.

- 3. Is your company government or private?**

It is a government agency.

4. What is your position?

My position is Section 504/Reasonable Accommodations specialist. It's a management program analyst. Some universal job code at Education but my focus is 504.

5. What is your primary mode of communication?

I can talk and sign as it needed with hearing people. If deaf then I will use ASL. Its like an on and off switch.

6. What kind of synchronous communication tools software/products do you use everyday at work?

I use MS outlook for email and AIM for IM for personal only, not related to work.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging)

I mainly use email for work only.

8. How often do you use synchronous communication tools?

I use e-mail daily.

9. Any positive aspects in using these tools?

Communication is more speedy, and no hearing is required.

10. Any negative aspects in using these tools?

There are no negative aspects.

11. Is privacy a concern? Why or why not?

Some days I don't care and some days I do because it's between one person and I.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

I simply unsubscribe them.

13. How do you deal with distraction?

I love multi-tasking. In fact I am doing that right now.

14. Do you think you have become addicted to using these tools? How?

Yep it's my toy addiction, especially talking to friends long distance, and it's free!

15. Have synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

No, because I have to be extra careful with the way I write.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Yes, it's between me and them and no more relying on someone else.

17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

I use both depending on the situation.

18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?

No, it is just the independence - perhaps it helps me to be more conscientious.

19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?

I rate my overall level of independence as 100%.

20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?

Communication access would be better if interpreters were not there.

21. If you were able to design synchronous communication tools, what would you do to improve them?

I would like to see more features added to IM for the deaf.

Interview with Laureen Mae Obermiller via Instant Messaging on 3/15/01.

1. What is your name?

My name is Laureen Mae Obermiller

2. How long have you been working for this company or agency?

I have been working for this agency for 14 years for Pension Benefit Guaranty Corporation under Department of Labor.

3. Is your company government or private?

It is a government agency.

4. What is your position?

I am a Team Leader.

5. What is your primary mode of communication?

My primary mode of communication is ASL.

6. What kind of synchronous communication tools software/products do you use everyday at work?

I use MS Mail and AIM.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging)

I still use electronic mail and instant messaging. I use them at work to communication with co-workers.

8. How often do you use synchronous communication tools? I work 40 hrs a week.

I leave both e-mail and IM open all the time except for Mondays. I check and open e-mail. I check periodically during the day. I would say between 32 to 40 hours a week.

9. Any positive aspects in using these tools?

Technically, I can communicate with email, Nextalk (TTY software) and IM at same time. I feel no different when using email with hearing employees.

10. Any negative aspects in using these tools?

When the LAN is down, nothing I can do about it... for example, our LAN system was down for one week - no contacts with anyone. Also, if my computer isn't working, I have to walk down to helpdesk and inform them of my problem with computer. Now, I have a pager and I can page helpdesk whenever I have a problem.

11. Is privacy a concern? Why or why not?

Not at all except where I sit my office. This is government property - nothing is private here. If I make some conversations on Nextalk, sometimes I feel there is no privacy. I have to tell others that I am on phone and will see them when I am done.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

Simple, I delete them without reading. For IM, I will not answer at all especially when I am busy.

13. How do you deal with distraction?

I will need to prioritize email. For example, if it is from friends, I will hold them till later when I have time and focus on work related emails. For IM, same thing I will not answer except for my mom and husband. They would check with me first to see if I am not busy.

14. Do you think you have become addicted to using these tools? How?

In the past, yes I used to be addicted to using these tools. But now I am used to this and I consider them as valuable tools.

15. Have synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

It's easy for me to follow up with their previous conversations but I have to be careful. I attended the management skills training a few weeks ago. I told the instructor that I use email all the time and it's the best communication method for me, but he told me that still I have to see some people in person not via email all the time. It was an interesting point of view. Sometimes I use this tool to avoid face-to-face conversation. It gives me the opportunity to type and correct before mailing it. In person, sometimes I feel like I am saying something wrong.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Yeah, definitely I don't have to depend on others to make phone calls. If supervisor asks me to contact someone, I would use email without hesitation.

17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

Yes, I am comfortable. I mostly use literary unless if I know someone very well then will use vernacular.

18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?

Yes, I can do it independently without asking someone else to do it for me like I used to long time ago.

19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?

I communicate with employees in writing, emailing and signing all the time. Interpreter comes here for meetings only. I would say 95 percent overall level of independence with hearing colleagues.

20. If more than 10 years with the company or government, how much improvement do you see in communication between deaf and/or hard-of-hearing and hearing colleagues?

A lot has changed since then. In the past, they would go to my co-workers and then co-workers would pass the message to me. But it's not done anymore. I think that hearing people feel more comfortable communicating with me via email than in person. It's just my opinion. Definitely and with better technology yet to come!

21. If you were able to design synchronous communication tools, what would you do to improve them?

Teleconferencing capabilities. Would be nice if we can use it without using a different cable. We have teleconferences here but in different rooms. It would be nice if I have one in my office.

Interview with Bridget Prentice in person on 3/8/01.

1. What is your name?

Her name is Bridget Prentice with Central Intelligence Agency.

2. How long have you been working for this company or agency?

She has been working for this agency for 6 years.

3. Is your company government or private?

It is a government agency.

4. What is your position?

She is a finance officer.

5. What is your primary mode of communication?

Her primary language is American Sign Language.

6. What kind of synchronous communication tools software/products do you use everyday at work?

She uses Lotus Notes for e-mail. She uses Sametime Connect for instant messaging.

7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

She is still using e-mail so she can keep her supervisor informed about her work. Her supervisor is in a different office and instant messaging makes it much easier to contact with her supervisor if she needs to discuss something.

8. How often do you use synchronous communication tools?

About 35 hours a week using e-mail and about 2 hours a week using instant messaging.

9. Any positive aspects in using these tools?

It helps her to communicate with other hearing people and she does not need to rely on interpreters. When she uses those tools, she learns more about her work projects because tools can give her in-depth details about what to do.

10. Any negative aspects in using these tools?

Sametime Connect can be interrupted while she is working on something else.

11. Is privacy a concern? Why or why not?

Not at all.

12. How do you deal with receiving unwanted material such as spam, e-mail, chat requests or offensive images and text?

Her agency uses a firewall to block unwanted materials.

13. How do you deal with distraction?

It is a bit frustrating for her when someone IM's her while she is really focusing on her work. She sometimes ignores the IM until she completes her tasks.

14. Do you think you have become addicted to using these tools? Why?

Yes, she feels that she needs to use them to communicate with other people.

15. Have the synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Yes, she feels confident using those tools since she does not have any problems with writing in English.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

She feels so independent using her e-mail all the time to talk with hearing people more than IM because she does not want to bother them.

- 17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

She uses both. It depends on what issues she needs to discuss.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing colleagues? How?**

Yes, since many hearing people are comfortable talking with her.

- 19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?**

She rates her overall level of independence in communicating with hearing colleagues with tools at 90%.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?**

They will be able to communicate with their supervisors. When the interpreters are not around, they can take advantage of tools to communicate with hearing people in the workplace.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

She would like to see e-mail and instant messaging with a feature of grammar and spelling correction like Ms Word has.

Interview with Willis Mann in person on 3/23/01.

- 1. What is your name?**

His name is Willis Mann. He works for MD Department of Budget & Management - Baltimore.

- 2. How long have you been working for this company or agency?**

He has been working there for 12 years.

- 3. Is your company government or private?**

His agency is a department of state government.

4. What is your position?

His position is a program manager for Telecommunication of Maryland and liaison for the governor's advisory board for telecommunication relay.

5. What is your primary mode of communication?

His primary mode of communication is Manually Coded English (MCE - ASL/voice at the same time)

6. What kind of synchronous communication tools software/products do you use everyday at work?

He uses Groupwise for e-mail by Novell. He could not use IM at work because of security.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging)

He still uses e-mail daily to communicate with his co-workers and keep up with updates.

8. How often do you use synchronous communication tools?

He uses it all the time (about 30 to 40 e-mail messages a day).

9. Any positive aspects in using these tools?

Ease of communication computer is an integral part of his job.

10. Any negative aspects in using these tools?

When he is on vacation and return back to the office, it is really hard for him to catch up on all of those e-mails. When the LAN is down, he can't do much work. He would feel a bit lost without the computer and can't complete his work without it.

11. Is privacy a concern? Why or why not?

Yes, he is concerned about privacy because there will be a new policy that all computers including e-mail and Internet will be monitored because a lot of people abused it.

- 12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?**

He does not get any spam at work. He would delete it if he sees any.

- 13. How do you deal with distraction?**

He is so used to it because he is able to multi-task job.

- 14. Do you think you have become addicted to using these tools? How?**

He would turn on the computer first thing in the morning when he arrives in the office to check e-mail and uses other tools on the computer. He is addicted to it.

- 15. Have synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?**

He feels so confident with it because he has a very strong background in English. He has a B.A. degree in English from Gallaudet University.

- 16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?**

Yes, he feels that this tool increases his independence because he can do things on his own. When he was working here about 12 years ago, he had an assistant who was also a part-time interpreter. Right now he does not have a part time interpreter but he still has an assistant for other tasks.

- 17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

He uses both as he depends on other people's English skills. If he knows someone very well, he would use vernacular. If it were related to his work or projects, he would use literary.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?**

Yes, he feels that it has improved his communication with hearing people because he does not have to rely on interpreters or go to other office to write notes. E-mail will do the job.

- 19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?**

He would rate his overall level of independence at 100%. He does not depend on hearing people for anything.

- 20. If more than 10 years with the company or government, how much improvement do you see in communication between deaf and/or hard-of-hearing and hearing colleagues?**

He notices that a lot of hearing people are aware of deafness compared to 30 years ago. Sign Language is more acceptable to hearing people. For example, 30 years ago, people would stare at deaf and/or hard-of-hearing who were signing. Nowadays, more hearing people will come towards you.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

He would put more buttons to pull up the files and send someone to chat via video conferencing instead of typing a name of a person that he would chat with via video conferencing.

Comments: e-mail in his office is very user-friendly. He thinks that 20 years from now, we will see more cellular phones with video built-in.

Figure 3: Transcripts of deaf and/or hard-of hearing private industry employees' interviews.

Interview with Joyce Brubaker in person 2/26/01.

- 1. What is your name?**

Joyce Brubaker with University of Colorado

- 2. How long have you been working for this company or agency?**

She has been working for this company for 4 months.

- 3. Is your company government or private?**

Her company is a private business.

- 4. What is your position?**

She is a media technology specialist.

5. What is your primary mode of communication?

Her primary language is American Sign Language

6. What kind of synchronous communication tools software/products do you use everyday at work?

She uses Outlook e-mail program and telnet at work.

7. Which of these tools are you still using? Why or Why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

She is still using e-mail and instant messaging but instant messaging is not related to work.

8. How often do you use synchronous communication tools?

She checks her e-mail approximately 5 times a day.

9. Any positive aspects in using these tools?

She feels that the tools are very useful. It is an effective communication tool to keep up with information.

10. Any negative aspects in using these tools?

There are no negative aspects in using these tools.

11. Is privacy a concern? Why or why not?

Yes, she is aware that her boss has access to her e-mail and makes sure it is related to work and not for her personal use.

12. How do you deal with receiving unwanted material such as spam, e-mail, chat requests or offensive images and text?

There is a firewall to block unwanted materials.

13. How do you deal with distraction?

She does not feel any distraction at this point.

14. Do you think you have become addicted to using these tools? Why?

Yes, she needs to check her e-mail to see if there is any more work for her or any other information related to her work.

15. Have the synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Yes, it is easy to communicate with hearing colleagues.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Yes, she is very independent and doesn't have to rely on interpreters.

17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

She tends to type her text in vernacular.

18. Do you feel that using the synchronous communication tools improves your ability to communicate with hearing colleagues? How?

Yes, she feels that it improves her ability to communicate with hearing colleagues so she does not have to wait for an interpreter to show up, and she gets an answer faster if she uses e-mail.

19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?

She rates her overall level of independence in communicating with hearing colleagues with tools at 100%.

20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?

There will be more accessibility for deaf and/or hard-of-hearing people. People can improve English skills by using the tools.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

She would make the tools more face-to-face like video conferencing, web cam, and not limited to text.

Interview Darrin Forshay in person on 3/12/01

- 1. What is your name?**

His name is Darrin Forshay.

- 2. How long have you been working for this company or agency?**

He has been working for Commonwealth One Federal Credit Union for 1 year.

- 3. Is your company government or private?**

His company is a non-profit organization.

- 4. What is your position?**

His position is a LAN specialist.

- 5. What is your primary mode of communication?**

His primary mode of communication is ASL and Voice as he is hard of hearing.

- 6. What kind of synchronous communication tools software/products do you use everyday at work?**

He uses IM – MSN and AIM. For e-mail, he uses AOL at work.

- 7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).**

He uses e-mail and IM for an emergency when people need to reach him, chat for short time and work related issues.

- 8. How often do you use synchronous communication tools?**

He uses IM about 5 hours a week and e-mail about 37 hours a week.

9. Any positive aspects in using these tools?

He can communicate with other employees related to work issues easily. More companies are using IM and it's easy for him to communicate with others. AIM has a conference room feature as well.

10. Any negative aspects in using these tools?

Junk e-mail.

11. Is privacy a concern? Why or why not?

None.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

He will just delete them and not open them at all.

13. How do you deal with distraction?

None.

14. Do you think you have become addicted to using these tools? How?

He is pretty flexible in using those tools and not really addicted to it.

15. Have using synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Yes, because hearing colleagues can't tell if he is hard of hearing.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Yes, he feels more independent when he communicates with hearing colleagues.

17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

Yes, but at work, he tends to use literary with hearing people. For deaf people, he uses vernacular. If he does not know that person well, he will try to keep it simple and short.

18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?

He notices that when he is using IM, it tends to be short but when he uses voice, it tends to be long. He also noticed that using IM is more expressive.

19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?

90%, sometimes he misunderstands at first, but that can be solved easily.

20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?

Yes, definitely because more deaf people have businesses and don't need to have a real, live interaction. If some jobs need to be done, it can be done via e-mail or IM.

21. If you were able to design the synchronous communication tools, what would you do to improve them?

Would design it for relay service, as it is much easier to use instead of making a phone call on TTY.

Interview with Rob Rice via Instant Messaging on 3/27/01.

1. What is your name?

My name is Robert Rice, and I work for Booz Allen & Hamilton, Inc. in McLean, VA.

2. How long have you been working for this company or agency?

I have been with the firm for 6 months now.

3. Is your company government or private?

Booz Allen is a privately owned firm.

4. What is your position?

My position title is "Associate."

5. What is your primary mode of communication?

My primary mode of communication at work is the spoken voice. My primary mode of communication with deaf people is ASL.

6. What kind of synchronous communication tools software/products do you use everyday at work?

Netscape Communicator email, AOL and Yahoo instant messaging, ICQ, Netmeeting/Videoconferencing, teleconferencing

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

Yes, I use all. Purpose is for communication with colleagues, clients, prospective clients and external affiliates. Scheduling. Often, IM/ICQ is used in lieu of telephone calls.

8. How often do you use synchronous communication tools?

All the time. 6 hours a day x 5 days a week = 30 hours a week.

9. Any positive aspects in using these tools?

I wouldn't be as successful as I am today if it weren't for those tools. The tools give me the access I need to total and unrestricted communication with colleagues, clients, etc.

10. Any negative aspects in using these tools?

Yes, some colleagues and clients hate using IM/ICQ or other tools. They prefer to communicate in person.

11. Is privacy a concern? Why or why not?

Privacy is always a concern. I do not want my work email or AOL IM address to be given out randomly. Most people I know are conscientious about my desire for privacy given that I am also a very private person.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

Most of my spam is on my personal AOL account. Only colleagues and business associates have access to my work email address. Being selective prevents me from getting spam. Sometimes friends IM me at

work I sometimes chat with them - but if I am busy, I will just put my "away" message on or tell them that they can talk another time. With AOL IM, sometimes it's hard to ward off unwanted IMs since email addresses get passed around fast via emails, etc. Also, eliminating your profile from the AOL client prevents people from sending you IMs marketing products or services.

13. How do you deal with distraction?

Amicably and professionally. Just tell friends/people that I am busy or need to chat another time. Turn on the AOL IM "I'm away" button. Ohh, that's multitasking... It's something you learn how to handle. I can handle 3-4 IM conversations at a time. Anything more than that, I will reschedule the IM meeting or tell the person that I am unavailable.

14. Do you think you have become addicted to using these tools? How?

I am not addicted... Email and IM are important business tools just like the telephone is to the hearing person. Are hearing people addicted to the telephone at work? No, they are not. Communication is critical in the workplace - how communication happens is just different. For me, it's in email and IM. For others, it's a combination of email, IM and the telephone.

15. Have using the synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Practice, practice and practice. I think when one learns how to use email effectively, intelligently and strategically, email can be a VERY effective communication tool with colleagues - sometimes even better than the telephone. As a result of this practice, my *overall* communications with colleagues have improved substantially - so has the confidence.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Same as above. Practice, practice and practice. I think when one learns how to use email effectively, intelligently and strategically, email can be a VERY effective communication tool with colleagues - sometimes even better than the telephone. As a result of this practice, my *overall* communications with colleagues have improved"

- 17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

I am very comfortable conversing in English with hearing colleagues. Whether or not I use formal English or not depends on the situation. If it's a work-related, business-related communication, then I will always be formal. If it's a socially related situation with a colleague, I will be informal. It just depends.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?**

Yes, it improves the communication because we are communicating MORE via IM/email than in person. However, this does not mean that the deaf person should stop attempting to communicate with the hearing colleague in person. Effective face-to-face communication will always be a critical factor of success in Corporate America.

- 19 In general, how would you rate your overall level of independence in communicating with hearing colleagues?**

I rate my overall level of independence very good to excellent.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?**

It's hard to say. In 10 years, the world may have a cure for deafness. Speech-to-text technology may dramatically change the way people work in Corporate America. It could go either way. Improvements in technology can either improve or hinder the deaf or hard of hearing worker's chances for success in the workplace.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

I'd love to see FAST and ACCURATE electronic tools that convert text into normal sounding speech and vice versa. This communication would be exchanged between computer and telephone allowing me full access to telephone conversations without dealing with the hassles and delays with relay operators, etc.

Comments:

I would like to ask you about Netmeeting, do you use it often or what? Do u use it as video conferencing? Yes but not often. About 5 times in the last 6 months. It's a good tool when conducting meetings that involve people from different cities or countries.

Are u able to read their lips or do you use the chat room to type the text? I can read lips and my residual hearing assists in communication. I never use chat rooms to type text to colleagues in person. I use my voice.

I'm not sure if I'm a qualified candidate for this interview... hmm.
I function 80% like a hearing person at work - the rest of the 20% is in email and via interpreters at large meetings or presentations, training, etc.

[He also uses PalTalk that is another program similar to Netmeeting, better chat interface.]

Interview with Louis Schwarz via Instant Messaging on 3/15/01.

1. What is your name?

My name is Louis J. Schwarz.

2. How long have you been working for this company or agency?

I am a part-time employee in Income Tax Service for the Deaf since 1971, part time life insurance agent since 1975, and with this financial planning firm since 1983.

3. Is your company government or private?

I own it myself - private

4. What is your position?

I am a financial planning advisor.

5. What is your primary mode of communication?

My primary mode of communication is ASL.

6. What kind of synchronous communication tools software/product do you use everyday at work?

I use Nextalk, Netscape Communicator, and AOL IM.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging)

Most of my applications are exclusively done by myself as financial planning advisor, such as financial independence planning, stock performance, etc - which are not considered as sharing application. I use both IM and email for communicating with my clients and my brokerage connections. My business involves confidential conversation so cannot I use electronic meeting board, etc.

8. How often do you use synchronous communication tools?

I would say IM and email use all of my spare time that I do not spend with my clients in person.

9. Any positive aspects in using these tools?

Instant conversations are also less time consuming via dialing and getting phone answers, not wasting time dialing and getting busy signals, have confidence in emails because of greater accuracy than over the answering machine etc.

10. Any negative aspects in using these tools?

Sometimes with emails, they do not come instantly - sometimes hanging in Internet network for a few hours or so. Only negative with ip-relay (ip-relay is a web-based relay service) is that the conversation cannot be printed while other means can be printed for records.

11. Is privacy a concern? Why or why not?

Privacy is a must because of the personal financial nature. I do use ip-relay for long distance calls.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

When I see first few lines and am not interested, I just delete it immediately. Yes, spams are as bad as junk faxes. I use one feature in my IM that only allows buddies to IM me if their screen names are on my list. So whoever wants to chat with me must email me first so I can add names to the buddy list. Also, I get many advertisement emails and I just delete them.

13. How do you deal with distraction?

I do have plenty of distractions! I have one TTY, one Nexttalk terminal, and one computer. I sometime forget one of them, mostly on either tty or Nexttalk when I became so focused with email or IM. Pretty well as long as I am aware of all chats or conversations. If it happens, I will avoid ip-relay because of no record. Besides my two-way pagers (I forgot to mention that in my previous answer), I am more addicted to my pager and try to be polite while with clients when the pager beeps. I turn off IM when I am with clients.

14. Do you think you have become addicted to using these tools? How?

With wonders of Internet, I notice I am more addicted lately than in the past.

15. Have using the synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Yes, they feel more comfortable communicating with me more than through relay and I have black and white records so no misunderstandings! I always ask hearing people for their emails when talking over relay.

16. Have synchronous communication tools allowed you to increase your independence in talking with hearing colleagues? How?

Look at question 15.

17. Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

I use vernacular over IM and formal over relay or email. Vernacular over pager too.

18. Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?

YES - less misunderstanding - more efficient - more details - even some were not aware that I am deaf.

19. In general, how would you rate your overall level of independence in communicating with hearing colleagues?

I grew up in the hearing community so I do feel comfortable talking with hearing people. I never felt helpless. So I would say 80% independence.

20. If more than 10 years with the company or government, how much improvement do you see in communication between deaf and or/ hard-of-hearing and hearing?

30 years with income tax service - 16 years with financial planning. I do see more dramatic improvements since I started the financial planning business. First it was relay, then it was fax, then it was email, then it was IM, then it is pager. Maybe soon it will be future video.

21. If you were able to design synchronous communication tools, what would you do to improve them?

Kind of cell phone with keyboard and color video - very portable one for everyone including both deaf people and hearing people - hard for deaf-blind! But somehow there should be one for deaf-blind. We must not overlook deaf-blind as well as blind people, including speech recognition for both parties - a million-dollars device? We have to be sure that people with differing abilities are not overlooked, whenever any product is invented.

Comments: I am aware that all relay agents have adhered to a code of ethics so I have to be over the phone line. IRS has a unique rule that the public is not aware of. IRS has a contract with Federal Relay Service (Sprint) that their agents will not accept any non-FRS calls. I like to use Maryland Relay Service (MRS) more than FRS because I am comfortable with MRS. I have told that MRS has Sprint contract. But the MRS agent cannot identify that it is Sprint too. I have to ask for MRS supervisor so supervisor will attest to IRS that this is the Sprint relay so IRS agent can proceed to talk with me. Yes MRS is Maryland Relay Service. I have submitted the complaint to IRS Counsel about this issue about a week ago to clarify this. Yeah - I pointed to IRS that Sec 504 says all agencies have to be accessible to all so let's see what IRS replies soon. One more I rather use email or IM rather than relay because it is verbatim. Some tend not to say every word that other person, mostly voicemail or answering machine, said. I had to ask them to type all details. Sometimes they do not say everything, for one example... one said would see you at 2 pm and I went over to that place. She was not there. So I came back and finally got a call from her asking why I did not show up. I was surprised that the relay agent did not say the name of place she said to agent. So relay

agents tend to assume the other party knows the trivial details. That is all about relay issues.

Interview with David Weiss via Instant Messaging on 3/26/01

1. What is your name?

My name is David Weiss and I work for Deaf and Disabled Telecommunications Program (DDTP).

2. How long have you been working for this company or agency?

I have been working for this company since May 2000.

3. Is your company government or private?

My company is an independent agency however it's affiliated with a state government agency (California Public Utilities Commission).

4. What is your position?

I am a California Relay Service Contract Manager.

5. What is your primary mode of communication?

I use ASL.

6. What kind of synchronous communication tools software/products do you use everyday at work?

I use Winterlink by Novell for e-mail and AIM for IM.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging)

I still use e-mail and IM for work-related communication with hearing people. It will save time to speak directly with someone than using phone. Usually it transfers to some other person, or it may be answered by voice mail or you are put on hold.

8. How often do you use synchronous communication tools?

I estimate about 25 hours per week to use both tools.

9. Any positive aspects in using these tools?

It is more efficient for communication with my internal staff as well as external vendors and customers.

10. Any negative aspects in using these tools?

Getting details as many as I want...for instance, deaf person has limited English...not able to give him details, rather use ASL in person or video conferencing.

11. Is privacy a concern? Why or why not?

Nah, it is a public company therefore I don't keep any confidential documents on line.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

Nah it hasn't happened to me yet. Oh goodness!

13. How do you deal with distraction?

Usually I use auto reply messages if I work on emails, etc.

14. Do you think you have become addicted to using these tools? How?

I don't think it becomes addictive unless I use video conferencing.

15. Have synchronous communication tools increased your confidence in using online communication with hearing colleagues? How?

Yes, it's a direct communication between other parties and myself rather using relay services (involving third party).

16. Have synchronous communication tools allowed you to increase your independence to talk with hearing colleagues? How?

Yes, I do not rely on Relay Services due to confidential info about relay services program and feel uncomfortable using relay operators on line though its public information and I do not have to get interpreters scheduled to talk with my hearing colleagues.

17. **Do you feel comfortable conversing in English with hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

Usually I type my text in vernacular.

18. **Do you feel that using synchronous communication tools improves your ability to communicate with hearing? How?**

Yes, indeed it develops my interpersonal attributes with my colleagues and they feel comfortable talking with me on line anytime.

19. **In general, how would you rate your overall level of independence in communicating with hearing colleagues?**

I would rate it "7" as of now. I would rate 10 if I use video conferencing stuff on a scale from 1 to 10.

20. **If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?**

Absolutely yes, it would resolve their communication issues eventually.

21. **If you were able to design synchronous communication tools, what would you do to improve them?**

Video conferencing with high advanced compression (quality of picture) if they use more (high) bandwidth... EnVision product has better picture quality for Deaf consumers.

Figure 4: Transcript of hearing government employees' interviews.

Interviewed with Toni Pineau via Instant Messaging on 3/27/01.

1. **What is your name?**

My name is Toni Pineau.

2. **How long have you been working for this company or agency?**

I have been working for this agency for 7 years for Navy.

3. Is your company government or private?

My agency is government.

4. What is your position?

I am a Sign Language Interpreter.

5. Do you know sign language? If so, what is kind of sign language?

Yes, I know ASL.

6. What kind of synchronous communication tools software/products do you use everyday at work?

I use Ms Outlook for e-mail.

7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

I still use e-mail. My agency is not allowed to use any other tools because of security.

8. How often do you use synchronous communication tools?

Never, I don't have any except for e-mail.

9. Any positive aspects in using these tools?

Not applicable. (NA)

10. Any negative aspects in using these tools?

NA

11. Is privacy a concern? Why or why not?

NA

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

I delete all "unwanted" email or email in which I do not recognize the sender.

13. How do you deal with distraction?

NA

14. Do you think you have become addicted to using these tools?

NA

15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or-hard of-hearing colleagues? How?

NA

16. Have synchronous communication tools allowed you to increase your independence in talking with deaf and/or-hard of-hearing colleagues? How?

NA

17. Do you feel comfortable conversing in English with Deaf/hard of hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

I email deaf and/or hard-of-hearing colleagues in the vernacular.

18. Do you feel that using synchronous communication tools improves your ability to communicate with deaf and/or-hard of-hearing colleagues using technology? How?

NA

19. In general, how would you rate your overall level of independence in communicating with deaf and/or-hard of-hearing colleagues?

Because I am a fluent ASL signer I am completely independent in communicating with deaf and hard-of-hearing colleagues.

20. If more than 10 years with the company or government, how much improvement do you see in communication between deaf and/or-hard of-hearing colleagues?

I think email has been a tremendous benefit for communication between deaf and hard-of-hearing colleagues.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

I have no idea...

Interviewed Suzanne Piper via Instant Messaging on 03/26/01

- 1. What is your name?**

My name is Suzanne K. Piper.

- 2. How long have you been working for this company or agency?**

I work for Department of Energy for 8 years. 7 years as Sign Language Interpreter, GS-12 and since May 2000 as Disability Employment Coordinator, GS-13.

- 3. Is your company government or private?**

My agency is government.

- 4. What is your position?**

Refer to question # 2.

- 5. Do you know sign language? If so, what is kind of sign language?**

Yes, I know American Sign Language.

- 6. What kind of synchronous communication tools software/products do you use everyday at work?**

I use MS Outlook for e-mail and AIM for IM.

- 7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).**

I still use e-mail and IM because it is for work. All the deaf/hard of hearing staff have e-mail and AIM. Using these are much better than TTY. They are faster, and the e-mail messages can be sent to my text pager as well, so I can be reached anywhere, any time.

8. How often do you use synchronous communication tools?

I rarely use AIM...not really very often. Maybe 1 hr/week total. E-mail, daily. Maybe total of 8-10 hours/week with the deaf staff.

9. Any positive aspects in using these tools?

IM is instant response. That is helpful when we need to reach each other for quick issues. E-mail: good for paging her, easy to use; also with e-mails they get a printable copy of what was sent/replied. I use the print option often since it is a proof of request for interpreting services, or verification.

10. Any negative aspects in using these tools?

E-mail: sometimes we are too dependent on it. If the LAN is down, it gets really frustrating. Also, there can be misunderstandings with written English (but that is rare)

11. Is privacy a concern? Why or why not?

No, not really. Although they tell them. They are monitored, the emails and IMs are work related, so no big deal. Their systems are unclassified, so no problem with security. They also have a firewall.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

I usually do not open messages that are not from a recognized individual or subject. If the subject is suspicious, I simply delete it without opening it. This is also a way to protect my system from viruses. They may be blocked. I do not get spam, but I do sometimes get emails from people I don't recognize. If I think it's suspicious, I delete it.

13. How do you deal with distraction?

Not a problem. IMs sometimes come at inconvenient times, but they are fast and easy to do, so no problem.

14. Do you think you have become addicted to using these tools?

(Laughing) I have to admit that I love my e-mail and IM. It certainly makes the job easier. Addicted? Yes, I guess to some extent, because I sure do get mad when the LAN doesn't work!

- 15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or hard of hearing colleagues? How?**

No, I do not think so. As an interpreter, I have been working (and socializing) with deaf folks since 1979. My confidence comes from my ASL skills. Using these tools just makes some things easier at work. I think the tools are a godsend to help deaf staff to communicate with hearing staff.

- 16. Have synchronous communication tools allowed you to increase your independence in talking with deaf and/or hard of hearing colleagues? How?**

No, I do not think so. Maybe if I couldn't sign, that might be the case. The deaf staff are now using AIM with co-workers and managers.

- 17. Do you feel comfortable conversing in English with deaf and/or hard of hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

Yes, using English is not a problem. I usually just type the message. If there is a problem, they let me know. Sometimes it's how I word the message, not their English comprehension. My messages are vernacular. Other messages that are broadcast on their e-mail system may be more to the literary side. Neither seems to be a problem. If it is, they usually come to me and they discuss it in ASL.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with deaf and/or hard of hearing using technology? How?**

Personal experience with various functions, etc. in the software makes me a better interpreter. It also means deaf people can use language that both of them understand.

- 19. In general, how would you rate your overall level of independence in communicating with deaf and/or hard of hearing colleagues?**

On a scale of 1 to 5, I would say 5.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard of hearing colleagues in the future?**

I think that the US as a whole is becoming more and more educated about the needs of people with disabilities (who in their eyes include deaf/hard of hearing, even though we don't feel that way...). This should lead to deaf/hard of hearing employees getting recognized for their abilities, not the disability. They should see more and more of them in higher positions. With the executive order to hire more persons with disabilities, I would hope that they are hired into key positions. Technology, such as e-mail and IM, will enhance their ability to communicate and to manage other employees. It should be a great asset. It should mean greater independence.

- 21. If you were able to design the synchronous communication tools, what would you do to improve?**

I believe I would add a decent video component. The video I have now is too jerky, but if they could smooth the picture so that they could have real-time communications, it would be great! Maybe add an automatic (and efficient) grammar check to the system. That may eliminate any grammar errors. BTW, hearing people need that grammar check too!

Interview with Sue Pressman via Instant Messaging on 4/11/01.

- 1. What is your name?**

My name is Sue Pressman

- 2. How long have you been working for this company or agency?**

I have been working for this agency for six years

- 3. Is your company government or private?**

It is a small business---government contractor

- 4. What is your position?**

I am an owner---Career Management Consultant

- 5. Do you know sign language? If so, what is kind of sign language?**

Yes---ASL.

6. What kind of synchronous communication tools software/product do you use everyday at work?

Electronic mail, Internet, Microsoft products/Outlook mail/AOL mail and instant messaging.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

E-mail (quick, easy, fast) Electronic mail, Internet, TTY, Microsoft products/Outlook mail/AOL mail and Instant messaging.

8. How often do you use the synchronous communication tools?

I use them daily.

9. Any positive aspects in using these tools?

It is easy, fast, and accessible in documenting data.

10. Any negative aspects in using these tools?

Instant messaging can sometimes be annoying.

11. Is privacy a concern? Why or why not?

Never had a problem

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

I delete them.

13. How do you deal with distraction?

I don't do distraction very well.

14. Do you think you have become addicted to using these tools?

I have become dependent because they are so reliable.

- 15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or hard-of-hearing colleagues? How?**

Yes -- easy access.

- 16. Have synchronous communication tools allowed you to increase your independence in talking with deaf and/or hard-of-hearing colleagues? How?**

Yes, I do not have to go through relay or use other forms of third party communication.

- 17. Do you feel comfortable conversing in English with deaf and/or hard-of-hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

I normally type in formal English and do not have a problem with the receivers of my message understanding me. The only thing I do sometimes is try to make the language as easy to understand as possible. I try to use language that has signs and/or idioms that are in terms or words that I know most Deaf people would be able to understand. But, I always communicate in English word order.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with deaf and/or hard-of-hearing using technology? How?**

Access has been increased. I would communicate or find a way regardless.

- 19. In general, how would you rate your overall level of independence in communicating with deaf and/or hard-of-hearing colleagues?**

Very easy for me, I have interpreter-level signing skills.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing in the future?**

No idea but hope things improve, that Deaf and Hard-of-Hearing will continue to advance and move into leadership and management positions.

- 21. If you were able to design the synchronous communication tools, what would you do to improve them?**

Have web cameras everywhere and teach hearing people how to access and work with deaf people.

Interview with James Watson via Instant Messaging on 03/29/01.

- 1. What is your name?**

My name is James Watson and I work for Central Intelligence Agency.

- 2. How long have you been working for this company or agency?**

I have been working for this agency for 16 years.

- 3. Is your company government or private?**

My agency is government.

- 4. What is your position?**

My position is Systems Engineer/Analyst.

- 5. Do you know sign language? If so, what is kind of sign language?**

No, I do not know sign language.

- 6. What kind of synchronous communication tools software/products do you use everyday at work?**

I use Lotus Notes for e-mail and Sametime Connect by Lotus for instant messaging.

- 7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).**

I still use e-mail and IM for work purposes.

- 8. How often do you use synchronous communication tools?**

I use e-mail about 5 hours a week and IM about 1 hour a week.

9. Any positive aspects in using these tools?

Of course, my office enterprise electronic connectivity is largely through Lotus Notes. Many administrative and project related tasks are done online through LN. E-mail has become a widely adopted and useful means of communicating and sharing information (including small application files, links to information, etc.). In many ways e-mail has become indispensable to being effective in the workplace and increasingly so in other relationships outside the workplace. Sametime has been very effective in communication between deaf and/or hard of hearing colleagues. It provides a common communication medium where they interact with equal efficiency.

10. Any negative aspects in using these tools?

They do have limitations, which create certain inefficiencies. For example, communication generally is more effective face-to-face and may be conducted more quickly that way. E-mail introduces a degree of formality, spelling grammar, etc associated with written text that is somewhat more "encumbering" than simple dialog. In the case of enterprise systems, efficiencies realized could be offset by system reliability and system access issues. If the system is "down" or if I do not have access to the system, then I may not be able to get his work done or use my time effectively.

11. Is privacy a concern? Why or why not?

Not for me personally. However, when using synchronous communication tools, one must be cognizant of the fact that communication may be monitored. In that sense, the range of information one communicates through these means is (wisely) constrained.

12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

For most of the synchronous communication tools I use this is not a problem. If I receive unwanted material and it is annoying and offensive, I simply delete it. Take Sametime Connect for example. When Sametime Connect was first deployed most users began adapting it to their work routine. Some would simply set it to be offline during certain times to avoid being interrupted during other work. So, one develops a certain style when adopting these new tools.

13. How do you deal with distraction?

I mentally prioritize e-mail when dealing with a large number and read accordingly. Other tools can be managed or scheduled to fit individual requirements.

14. Do you think you have become addicted to using these tools?

No. However, addiction to "tech tools" is real. I am sure, although I am lack quantitative information, that productive work time is lost to this type of problem in the workplace.

15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or-hard of-hearing colleagues? How?

I would not describe it as increasing my confidence. As I cited above, the Sametime Connect tool has been very effective for communications in the workplace. Because of my part-time schedule, I have not attended the sign language classes offered at work. So, Sametime Connect has provided a nice communication medium - as we are doing now.

16. Have synchronous communication tools allowed you to increase your independence to talk with deaf and/or hard-of-hearing colleagues? How?

Synchronous communication tools have "enabled" me to communicate more effectively with deaf and/or hard-of-hearing colleagues, as stated above.

17. Do you feel comfortable conversing in English with Deaf/hard of hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

Yes, conversing in the sense of writing or using synchronous communication tools. I do occasionally use vernacular. In general I have found formal English to be more appropriate and effective in the synchronous communication tools environment.

18. Do you feel that using synchronous communication tools improves your ability to communicate with deaf and/or-hard of-hearing colleagues using technology? How?

Yes, technology can be used for many different things. Synchronous communication tools inherently depend upon a networked computing

environment, then these tools may be used to improve interpersonal communications, overcoming barriers to conventional speech.

19. In general, how would you rate your overall level of independence in communicating with deaf and/or-hard of-hearing colleagues?

I would not rate myself highly. As I have not mastered sign language, I am dependent on written or electronic means to effectively communicate with deaf and/or hard-of-hearing colleagues.

20. If more than 10 years with the company or government, how much improvement do you see in communication between deaf and/or-hard of-hearing and hearing colleagues?

I see that much progress has been made. More of my offices are developing awareness of and skills in sign language. In general I see this agency in the forefront of incorporating all people into the workplace, including those who are deaf and/or hard-of-hearing.

21. If you were able to design synchronous communication tools, what would you do to improve them?

The user interface issues need to evolve to the point where these tools can be used easily by those who don't know how to use a computer as we think of it today. The phone (POTS - plain old phone service) is really the model. The telephone is simple to use, intuitive, and accommodates a lot of complexity in a reliable manner. This is where synchronous communication tools will have to go to be embraced by a wider range of users.

Figure 5: Transcripts of hearing private industry interviews.

Interview with Janet Bailey via Instant Messaging on 3/12/2001.

1. What is your name?

My name is Janet L. Bailey.

2. How long have you been working for this company or agency?

I have been working for this company for 18 years.

3. Is your company government or private?

My company is a private business.

4. What is your position?

My position is a CEO, owner.

5. Do you know sign language? If so, what is kind of sign language?

Yes, I am a certified interpreter.

6. What kind of synchronous communication tools software/products do you use everyday at work?

I use Ms Outlook 2000 Express e-mail and American Online Instant Messaging.

7. Which of these tools are you still using? Why or why not? (e.g; sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

I still use e-mail and IM to run my business and communicate with co-workers.

8. How often do you use the synchronous communication tools?

All day – but most one-on-one communication is done through sign.

9. Any positive aspects in using these tools?

E-mail is the best way to assure that our deaf employees are involved in office communication. We have over 50 interpreters on staff who are not in the office most of the time... therefore voice-mail has become the easiest way to share information with them. The voice mail system, however, is not easily shared with our deaf employees – e-mail is much more inclusive.

10. Any negative aspects in using these tools?

None.

11. Is privacy a concern? Why or why not?

No.

- 12. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?**

It has been a normal negative we frequently alert staff to virus concerns and everyone has learned how to avoid spam by eliminating it instead of opening it.

- 13. How do you deal with distraction?**

No, I love e-mail & I have never found it to be distracting - I use IM's for instant needs - not all the time, so they have not been too bothersome. I truly find that I am now doing well over 70% of my work on e-mail.

- 14. Do you think you have become addicted to using these tools?**

No.

- 15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or hard-of-hearing colleagues? How?**

This company uses computers and e-mail daily – using it with our deaf and/or hard-of-hearing is just one aspect of our computerization.

- 16. Have synchronous communication tools allowed you to increase your independence to talk with deaf and/or hard-of-hearing colleagues? How?**

This is true for employees who are non-signers or those still learning sign. I believe it does increase the amount of dialogue between the deaf and/or hard-of-hearing and non-signing employees.

- 17. Do you feel comfortable conversing in English with Deaf and/or hard-of-hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

Both – although most e-mail language tends to be informal. I believe hearing people do consider the level of English when sending to deaf and/or hard-of-hearing individuals or any second language user.

- 18. Do you feel that using the synchronous communication tools improves your ability to communicate with deaf and/or hard-of-hearing using technology? How?**

Clearly e-mail is the easiest way for deaf and/or hard-of-hearing people to communicate with businesses... however, I also believe that e-mail business is easier with hearing people, too!

- 19. In general, how would you rate your overall level of independence in communicating with deaf and/or hard-of-hearing colleagues?**

Very high.

- 20. If more than 10 years with the company or government, what do you think it will happen to deaf and/or hard-of-hearing in the future?**

In my own company and as witnessed in various government and private offices – technology has improved communication access for all – especially deaf employees. It can only get better. The use of interactive pagers has revolutionized life for deaf and/or hard-of-hearing individuals and, I predict, as the costs go down – they will positively impact business.

- 21. If you were able to design synchronous communication tools, what would you do to improve?**

Each new “toy” has been better and faster and more useful - cheaper is the next hurdle.

Interview with Julie Hall in person on 2/23/01.

- 1. What is your name?**

Her name is Julie Hall with Element K.

- 2. How long have you been working for this company or agency?**

She has been working for this company for 7 months.

- 3. Is your company government or private?**

This company is a private business.

- 4. What is your position?**

She is a Federal Account Manager.

5. Do you know sign language? If so, what kind of sign language?

She knows American Sign Language but not fluently.

6. What kind of synchronous communication tools software/products do you use everyday at work?

She uses Lotus Notes for e-mail, American Online Instant Messaging for instant messaging, and Centra for electronic meeting rooms.

7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

She is still using e-mail, instant messaging and electronic meeting room.

8. How often do you use synchronous communication tools?

She is using e-mail about 20 hours a week, instant messaging about 20 hours a week and electronic meeting room about 3 hours a month.

9. Any positive aspects in using these tools?

She can talk with deaf and/or hard-of-hearing colleagues. It will save money on any long distance telephone calls and it is quicker to reach people online. She can do multi-tasking at once.

10. Any negative aspects in using these tools?

She can't use it in the car when she needs to reach some deaf and/or hard-of-hearing customers. If she need to reach her company in Rochester (headquarters), she may have a hard time to call them because of voice mail. Instant messaging is the best thing for her to reach her company. E-mail and AIM are the best options for her but if she is in the car, she needs to wait until she arrives in her office to send or check the e-mail or AIM for an answer.

11. Is privacy a concern? Why or why not?

No, because she does not have anything to hide.

12. How do you deal with receiving unwanted material such as spam, e-mail, chat requests or offensive images and text?

She will delete them or e-mail them to tell them to stop sending e-mail to her.

13. How do you deal with distractions?

She does not mind because she types real fast and can deal with distractions.

14. Do you think you have become addicted to using these tools? Why?

Yes, because it is faster, easier, quicker and she gets answers faster.

15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or hard-of-hearing colleagues? How?

Yes, it has increased her confidence very much. It is easier for her to communicate with deaf and/or hard-of-hearing online and more comfortable to chat with deaf and/or hard-of-hearing.

16. Have synchronous communication tools allowed you to increase your independence in talking with deaf and/or hard-of-hearing colleagues? How?

Yes, she does not need to rely on interpreters. She also doesn't need to use the relay service because they are so slow.

17. Do you feel comfortable conversing in English with deaf and/or hard-of-hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

Yes, she can understand the difference and knows deaf and/or hard-of-hearing's culture. She tends to type in literary.

18. Do you feel that using synchronous communication tools improve your ability to communicate with deaf and/or hard-of-hearing colleagues? How?

Big yes because it is easy and saves a lot of time.

19. In general, how would you rate your overall level of independence in communicating with deaf and/or hard-of-hearing colleagues?

She rates her overall of independence in communicating with deaf and/or hard-of-hearing about 90%.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?**

A lot, who knows? There will be a lot of better inventions to make the communication more effective.

- 21. If you were able to design synchronous communication tools, what would you do to improve them?**

She would like to add a button to say "no" to the instant messaging when she is on the phone, instead of using "away" mode.

Interview with Carla LaFever in person on 3/14/01.

- 1. What is your name?**

Her name is Carla LaFever.

- 2. How long have you been working for this company or agency?**

She has been working for MCI WorldCom for 16 years.

- 3. Is your company government or private?**

Her company is a private business.

- 4. What is your position?**

She is director.

- 5. What kind of synchronous communication tools software/product do you use everyday at work?**

She uses American Online Instant Messaging (AIM).

- 6. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging). Chat/IRC, e-mail and instant messaging.**

Because with e-mail she can communicate with other people all over the world with different time zones. Some people work at night. She can use IM and make phone calls at the same time.

7. How often do you use synchronous communication tools?

She always leaves her instant messaging on all the time.

8. Any positive aspects in using these tools?

Yes, she is able to talk with many people on IM at the same time about different issues. It is more private for her to talk with other people on IM. It helps her to contact people if she needs to know something rather than waiting for them to reply to her e-mail.

9. Any negative aspects in using these tools?

Yes, when she meets someone online tends to type real fast while other people type slow. Sometime it is hard to tell if she is talking to a specific person about a topic then it ends up being a different person because all the dialog boxes look all same. It can interrupt her when she is talking with someone else about something that is very important and her mind can go blank when she needs to say something. It is really hard to focus on IM when there are interruptions.

10. Is privacy a concern? Why or why not?

Yes, all conversation will be recorded on American Online Instant Messaging's server but she was able to make a direct connection to her buddy's computer so that she can talk with her buddy privately because it will not be recorded on American Online Instant Messaging's server.

11. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

She will simply delete them. If someone that she never heard of wants to talk with her via IM, she will just reject the IM.

12. How do you deal with distractions?

She will tell them that she is not able to talk at that point or turn the IM off.

13. Do you think you have become addicted to using these tools?

Yes

- 14. Do you think that using synchronous communication tools will increase hearing's confidence in communicating online with deaf and/or hard of hearing colleagues? How?**

Yes, she thinks it will increase hearing's confidence in communicating online with deaf and/or hard-of-hearing. For example, when she first met me in person, she did not realize that I was deaf.

- 15. Do you think that synchronous communication tools will allow hearing people to increase their independence to talk with deaf and/or hard of hearing colleagues? How?**

Yes, she can talk with people at anytime and doesn't need to wait for anyone to interpret and doesn't need to depend on writing down on paper while there are technologies available to use.

- 16. Do you feel that synchronous communication tools will improve hearing people's ability to communicate with deaf/hard of hearing using technology? How?**

Yes, she used to have a TTY or use the relay service or a sign language interpreter; it makes her life easier to use instant messaging because it is much quicker.

- 17. When do you converse online with colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

She uses both, but when she talks with someone who are important or from the business world, she would use literary. If she talk with friends, she would use vernacular.

- 18. I know that you don't have much experience with deaf/hard of hearing people but what do you think is going to happen within 5 years? How quickly will the technology improve?**

She thinks that IM is a very good example and it will allow more interactions between deaf and/or hard-of-hearing and hearing people by using pagers, fax and some other new technologies. It is easy to use them and it can used anywhere when she is not in the office. And also it will reach a critical mass: the technology will go faster and change rapidly.

- 19. If you were able to design synchronous communication tools, what would you do to improve them?**

She would suggest having the telephone to be used as a pager. Set up IM as 3-way communication feature. She also would like to see the cellular phones become Internet accessible like Japan has.

Interview with Mary Mosimann via Instant Messaging on 3/8/01.

- 1. What is your name?**

My name is Mary Mosimann with Litton TASC.

- 2. How long have you been working for this company or agency?**

I have been working for this company for 5 years.

- 3. Is your company government or private?**

This company is a private business.

- 4. What is your position?**

I am a web developer (software engineering).

- 5. Do you know sign language? If so, what kind of sign language?**

No, but I do know fingerspelling.

- 6. What kind of synchronous communication tools software/products do you use everyday at work?**

The software/product that I have been using is Sametime Connect by Lotus.

- 7. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).**

I am using e-mail and instant messaging most of the time. For IM, it is convenient especially for meetings and when I don't have to leave my desk and if someone really needs to reach me.

- 8. How often do you use synchronous communication tools?**

Approximately 2 hours to use IM per week.

9. Any positive aspects in using these tools?

It saves time, especially with customers that need to reach me from other floors of the building or other buildings. Also, they can use this rather than the telephone and they know if I am at my desk.

10. Any negative aspects in using these tools?

When I am in a program (Photoshop, Corel Draw) it can interrupt my work. Then I have to save my work and close out if I am going to have a conversation (long one). If I am on a really hot project, then I turn off Sametime Connect.

11. Is privacy a concern? Why or why not?

Yes, privacy is a concern but no more than anywhere else (Lotus Notes and Sametime Connect). Everything at the office is monitored, even they speak on the telephone.

12. How do you deal with receiving unwanted material such as spam, e-mail, chat requests or offensive images and text?

They don't receive anything offensive at my office.

13. How do you deal with distraction?

I try to turn off the Sametime Connect but if I have distraction, people coming in etc, then I try to talk to them shortly and get back to my work.

14. Do you think you have become addicted to using these tools?

No, because I still use the telephone and also I attend (in person) meetings.

15. Have synchronous communication tools increased your confidence in using online communication with deaf and/or hard-of-hearing colleagues? How?

Yes, because I can communicate in the same manner as I would with my other colleagues.

- 16. Have synchronous communication tools allowed you to increase your independence in talking with deaf and/or hard-of-hearing colleagues? How?**

Yes, because I do not have to rely on an interpreter, and I do not have to rely on sign language. I can talk in real time, even if they are in another building or room.

- 17. Do you feel comfortable conversing in English with deaf and/or hard-of-hearing colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

In the past, I typed my conversation in literary (I was a technical writer). Now I use in vernacular because people seem to be more comfortable with a conversational style of speech.

- 18. Do you feel that using synchronous communication tools improves your ability to communicate with deaf and/or hard-of-hearing colleagues? How?**

I am very comfortable conversing in English with my deaf and/or hard-of-hearing colleagues.

- 19. In general, how would you rate your overall level of independence in communicating with deaf and/or hard-of-hearing colleagues?**

The rate is very good on my overall level of independence in communicating with deaf and/or hard-of-hearing colleagues. It improves my ability to communicate because I can communicate more quickly, and I do not have to rely on sign language or interpreters.

- 20. If less than 10 years with the company or government, what do you think will happen to deaf and/or hard-of-hearing colleagues in the future?**

I think that deaf and/or hard-of-hearing colleagues will rely more heavily on synchronous communication tools. I think that there will also be video (see the people you are speaking with) and there will be white boards, and graphical tools such as maps, slides, pictures, photos, and videos.

- 21. If you were able to design the synchronous communication tools, what would you do to improve them?**

I would enhance the tools with more photos, graphics, white boards and video in the future.

Comments: She likes the tools, and she feel that she can communicate with deaf and/or hard-of-hearing colleagues as well as with any other colleagues when she is using the tools.

Figure 6: Transcript of special interview for deaf and/or hard-of hearing researchers.

Interview with Nancy Kensicki via Instant Messaging on 3/26/01.

1. What is your name?

My name is Nancy Kensicki.

2. How long have you been working for this company or agency?

This will be my 34th year at Gallaudet this July.

3. Is your company government or private?

Gallaudet's focus is educational, but its employees receive federal paychecks.

4. What is your position?

I am a professor of English.

5. What kind of synchronous communication tools software/products do you use everyday at work?

I mostly use email and the Internet, and very rarely, instant messaging and chat rooms.

6. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

Needless to say, I can't survive in my job without email. As for instant messaging and chat/IRC, I am not very familiar with them, and my colleagues don't use them either.

According to Gallaudet, electronic whiteboards are too expensive. I would have enjoyed using them in my classrooms. My students use the forum (actually chat room, but it's not instant, meaning that one has to enter via an entry and then click out), but they would rather be in my classroom using ASL.

7. How often do you use the synchronous communication tools?

In my job, I use email daily, about every hour. I use the Internet about once a week and the forum about once every two or three weeks.

8. Any positive aspects in using these tools?

I like emails better than TTYs. This way, I won't have to chase after somebody when I use the TTY. And I think better when I have more time in replying to messages via email.

I do online courses, but only with students who are computer-wise. I've found that freshmen don't like online courses because they would rather see their teacher. But once they get used to online courses, they like them because they don't have to go to class.

9. Any negative aspects in using these tools?

With email, Gallaudet's servers often go down, causing us some frustration, which shows that they can't live without email!

I wish Gallaudet employees would be trained to use ALL tools. I think the main problem is that they just don't know how to use most of these tools.

10. Is privacy a concern? Why or why not?

At Gallaudet, I do not think privacy is a concern since my students are being taught to do research. I do not send grades to my students unless they send me email asking for them.

11. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

I simply delete them.

12. How do you deal with distraction?

At Gallaudet, I've never used IM with my colleagues. In fact, I think only students use IM very often. At home, I had about two or three distractions within a year, and simply ignored them.

13. Do you think you have become addicted to using these tools?

Yes, with email. The other tools I can live without for now. As I have indicated above, they need training to make better use of them.

- 14. Do you think that using synchronous communication tools will increase deaf and/or hard-of-hearing's confidence in communicating online with hearing colleagues? How?**

Yes—only if deaf and hard of hearing people have confidence in their English skills. Too many deaf and hard of hearing people think that their English skills are inferior so they try to avoid communicating with hearing coworkers via email.

Otherwise, email is an excellent tool for deaf and hard of hearing people. It puts them on equal par with hearing coworkers.

- 15. Do you feel that synchronous communication tools will become very popular in the workplace in the future?**

Definitely! In my business English workshops, I have been told again and again by participants that they cannot do their jobs without email.

- 16. Do you feel that synchronous communication tools will lead people to have fewer interactions face-to-face?**

Yes, this can be a problem. With new employees, it has become hard for me to associate names and faces. The human touch can be lost.

- 17. When do you converse online with colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

I teach English so I am careful what I type to my students as well as my colleagues. But with my home email, I disregard capitalization, punctuation, etc.

- 18. What do you think is going to happen within 5 years? How quickly will the technology improve?**

Fifteen years ago, I wouldn't have touched a computer with a ten-foot pole. Today, I am addicted to the computer. I am very positive that other tools will become useful, particularly instant messaging.

- 19. If you were able to design synchronous communication tools, what would you do to improve them?**

For my online courses, I would put in videotapes showing me using ASL. I suppose for deaf and hard of hearing employees, they would rather talk to each other using videophones. As for talking to hearing employees, I think instant messaging is the way.

I also think that designing synchronous communication tools isn't the answer—these tools are already here. I would design training courses to help employees understand how to work with these tools.

Interview with Norman Williams via Instant Messaging on 3/26/01.

1. What is your name?

My name is Norman Scott Williams.

2. How long have you been working for this company or agency?

I have been working for Gallaudet University for 11 years.

3. Is your company government or private?

Gallaudet University is private but depends heavily on federal funds.

4. What is your position?

I am a Computer Scientist.

5. What kind of synchronous communication tools software/product do you use everyday at work?

I use AIM, Netmeeting, and Envision (video chat). Also for NTS for TTY calls (from NXI)

6. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

AIM: heavily used. It is easy to communicate with different people at same time even with separate conversation.

Netmeeting and Envision: It is nice to have video chat to save time for heavy discussion.

I don't use sharing apps like in Netmeeting. I didn't need to. I don't use Chat/IRC because AIM is enough. I do use email a lot too.

Text and video chats are what I use regularly.

7. How often do you use synchronous communication tools?

AIM: Everyday (probably 1 or 2 hours a day).

Video chats: average 30 minutes a day.

8. Any positive aspects in using these tools?

Compared to TTY calls, they are time savers! Also, I try to ask for AIM screen name when I call for tech support. I do get few such as Mindspring They use AIM and found it much easier to communicate because of occasional technical terms that relay didn't understand. If the call is short or one time only, I won't ask.

9. Any negative aspects in using these tools?

Compared to TTY calls, I would miss messages if I am not near the PC. It has no light flashing. If I am very busy, I would only want to talk to 1 person but everyone else will see me on line. There is no feature for AIM at all while ICQ has it. But the disadvantage of ICQ is in real time chat with a few people at the same time, it will cause stress jumping around conversation. It is good for char by char chat with line by line AIM is easier to jump around conversation without telling them PLS HD I AM TALKING TO SOMEONE ELSE. If ICQ can force line by line chats, it might work. I think MSN Messaging will answer this they are supposed to come out with new version anytime.

10. Is privacy a concern?

Not a big concern unless there is security risk entering my hard disk for data or selling my email address.

11. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

I just ignore it. If I reply REMOVE email, they will know my email address is good. They will put my email address in another list and sell it. For emails that have instruction it is best to delete them rather than remove it. Some senders will remove my email address from their list, but will add my email address to "GOOD" email list and sell the list to some other companies.

12. How do you deal with distraction?

For those who IMed me regularly, I just ignore them for a few minutes. For people who I don't talk much, i just typed PLS HD. For emails, I don't reply until the time is right. For video chat, I just ignore it and call back later. Most of my friends use IM first before video call.

13. Do you think you have become addicted to using these tools?

No, they are just time savers compared to TTYs.

14. Do you think that using synchronous communication tools it will increase deaf and/or hard-of-hearing's confidence in communicating online with hearing colleagues? How?

Yeah, For both in video relay and in person there won't be any misspellings introduced by relay calls or misunderstood topics by interpreters very often. The interpreters must understand concept before doing a good translation.

With text chat, it is exact word for word in person or in video (I am talking about heavy technical interpreting) text chat is lot better but requires more time for typing. For example, I prefer to use AIM with Mindspring tech support to live video interpreting!

15. Do you feel that synchronous communication tools will become very popular in the workplace in the future?

For long term relations, yes they will be popular. For short term or one time thing, a phone call will still be used.

16. Do you feel that synchronous communication tools will lead people to have fewer interactions face-to-face?

Yes, if the hearing people don't know signs. if I talk to few people at same time with separate conversations (not group chat), I prefer AIM to handle better. Same idea for hearing people that they handle 1 voice calls at a time. If just one to one, face to face (or via video) is better. AIM is better to talk with few people at same time separately. Video is for one to one or groups chat where we talk together. For Mindspring tech support, of course I will not see them ever. For friends, I still do see them so I am balanced to use tools and interact with people.

17. When do you converse via online with colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?

I used mixed, not very formal, but good English but few abbreviated words, just like what I use now with you.

- 18. What do you think is going to happen within 5 years? How quickly will the technology improve?**

Video chat will grow a lot text chat will probably talk more to other servers (MSN, ICQ, etc) and maybe some more features. And we may have wireless video phones in use real soon.

- 19. If you were able to design synchronous communication tools, what would you do to improve?**

Save conversations effortlessly and review them. AIM doesn't offer that. I must save them as HTML and I have to file and organize it myself. Even though it can be saved as txt file but it requires a lot of work for all conversations. It would be nice for AIM to pop question "save to which folder" and easily review later. ICQ has that.. Also I wanted to add my remarks next to AIM screen names so I can remember who, for example: I have ICRCRC on my screen name, I can't remember who that is. It would be nice if I can rename or maybe add remark to them.

Comments: I work on different projects. One is to develop error rate measuring software for TTYs to go through digital wireless phones. Other project I am developing video on CDs for engineer to evaluate signing video through videoconference system. All projects are grants based. Engineers who design video conferencing don't know how well their system is for signers. All they have to do is play DVD movie to the system and see what frames per sec they get and monitor the quality instead of having a live person signing. For 128k, use H.263 compression, which is a newer standard. H.261 (H.261 and H.263 are compression standards) works well. It won't be TV quality, but no repeats needed. I think video chat on Internet will success the most in few years. I think video chat on Internet will success the most in few years because they are free and are easier to work with.

Figure 7: transcript of special interview for a hearing researcher.

Interview with David Coleman via Instant Messaging on 3/14/01.

- 1. What is your name?**

My name is David Coleman.

- 2. How long have you been working for this company or agency?**

12 years – started in 1989.

3. Is your company government or private?

Private, an LLC.

4. What is your position?

My position is Managing Director.

5. What kind of synchronous communication tools software/product do you use everyday at work?

Placeware, Netmeeting, Webex, SameTime, Evoke, Buddyhelp, AIM, Yahoo Messenger, you name it. Since they are analysts in this area, they use a lot of different tools

6. Which of these tools are you still using? Why or why not? (e.g., sharing applications, chat/IRC, electronic mail [e-mail], electronic meeting rooms, electronic white boards, and instant messaging).

All of them. They are not a normal user though. They have been using these tools regularly for 3 years. They are "early adopters" and because of our role as analysts in this area they need to walk our talk.

7. How often do you use synchronous communication tools?

Probably everyday I would say, I do IM or chat with someone. They have clients and subscribers on IM that send us questions. Also by e-mail and even by fax or phone.

8. Any positive aspects in using these tools?

Yes, it enables a much faster cycle time for collaboration than e-mail. Also because it is a different medium, I can sometime be reached by IM when I am not reachable (he is on the) phone. Also I can share data through IM and that is hard to do over the phone especially for a picture or a large document or a graphic.

9. Any negative aspects in using these tools?

Yes, on the phone you can tell a person's emotional tone from their tone of voice, but not on IM. You can use emoticons >:o but they are a poor substitute. IM is good for transfer of information or status, but is a poor tool for negotiation, innovation, discovery, or other collaborative processes.

10. Is privacy a concern? Why or why not?

Not really generally I chat one-to-one with a client. In terms of security why should my chat or IM be any more secure than my phone calls? And they often deal with sensitive topics.

11. How do you deal with receiving unwanted material such as spam, email, chat requests or offensive images and text?

Well, I trash the stuff that gets through the spam filters, and add the sender to my spam list. It takes a lot to offend me!

12. How do you deal with distraction?

I have ADD. What distraction? I am always doing multiple things. I get over 100 e-mails a day and I deal with it. I answer the critical ones right away. We have a commitment to our clients and partners to respond within 24 hours, to phone call or e-mail. The others I store and get to when I can, usually on the weekend or a few days later. About average for someone in my position. I have talked to colleagues and they get about the same. All part of the service. If I can not model good collaborative behaviors how can I ask my clients to?

13. Do you think you have become addicted to using these tools?

No, I use them as tools for work when I need them.

14. Do you think that using synchronous communication tools will increase hearing's confidence in communicating online with deaf and/or hard of hearing colleagues? How?

I am not sure I am qualified to answer that one, since this is the first time I have done this with someone who is hearing impaired. Are you ok with the conversation? If so, then I would say "yes."

15. Do you feel that synchronous communication tools will become very popular in the workplace in the future?

Yes, very much so. We have done a lot of research on this. Right now I would say penetration is less than 10% so there will be a lot of growth over the next few years.

- 16. Do you feel that synchronous communication tools will lead people to have fewer interactions face-to-face?**

No, it will be in addition to f2f. For example, I met my fiancée on line, she is a friend of a friend. We chatted on line, then on the phone and finally met f2f after a few months. So the chat augmented the relationship. We are getting married July 1, by the way! Can't say I do not use this technology in both my work and personal life.

- 17. When do you converse via online with colleagues at work? If so, do you type your text in literary (formal English) or vernacular (informal English)?**

Vernacular, I am a pretty fast typist, almost 100 words a minute. So I go for speed rather than accuracy.

- 18. I know that you don't have much experience with deaf/hard of hearing people but what do you think is going to happen within 5 years? How quickly will the technology improve?**

Well I am sure that more hearing impaired people will use it. I have seen some on AOL in chat rooms that in their profile say they are hearing impaired. I think this will be quite common in 5 years. I heard somewhere that there were almost one billion chat or IM conversations estimated each day!

- 19. If you were able to design synchronous communication tools, what would you do improve them?**

hmmm, that is hard. I would make sure all tools had presence indicators (and many do, i.e. buddy list). I also would make sure there was an easy way to support persistence. For example, a way to make this conversation go into a threaded discussion at the touch of a button so that we could continue anytime we wanted (asynchronous). I also want several channels, i.e. a channel to talk to everyone and a channel to "whisper" to another person on what we are seeing. I also would add intelligence around bandwidth, so that if I have the bandwidth to do video chat, the application would figure that out.

Appendix C - Glossary

Assistive Technology Provides innovative solutions to help people with learning, communication, and access difficulties to lead more independent and productive lives. (e.g.; TTY, phone with amplifier and braille)

Asynchronous Communication Tool - Software used to help people in a group, but not requiring the group members to work together at the same time. (Asynchronous = not coordinating at a single point in time, e.g., e-mail)

Application Sharing - This tool is useful when a number of people in different locations have to work together on a project. You can start an online meeting and share any application running on your computer. Application sharing works very well where editing is to be done in real-time. A group located in different cities can collaborate effectively on editing a MS Word document or any other applications. One person chairs the meeting while another types the changes using MS Word or any other applications' edit marking function. The others participate by phone and watch the changes as they are being made.

Chat/IRC (Internet Relay Chat) - Software that enables multiple people in real time to write messages in a public space, in typewritten text. As each person submits a message, it appears at the bottom of a scrolling screen.(e.g., ICQ and MIRC)

Electronic Mail (e-mail) The transmission of messages over communication networks. The messages can be notes entered from the keyboard or electronic files stored on disk. Most mainframes, minicomputers, and computer networks have an e-mail system. Some electronic-mail systems are confined to a single computer system or network, but others have gateways to other computer systems, enabling users to send electronic mail anywhere in the world. While this application is an asynchronous communication tool, it also has the capability to serve as a "bridge" to synchronous communication tools.

Electronic Meeting Rooms Software that creates an online meeting environment that includes application sharing, electronic whiteboard and the participant list. A participant list allows the moderator to give participants permission to work actively during the meeting. Anyone can view the list to see who is in the meeting and who has permission.

Electronic Whiteboards - It can convert an image or map into whiteboard pictures. During online meeting you can view picture and use the whiteboard to draw colorful circles or arrows. You can also enter text

comments next to parts of the picture that are important in order to clarify the point you are trying to make, or obtain the information you need.

Instant Messaging - Software that provides a technique of sending a message. The sender specifies the recipient and typically types a simple text message. The recipient has a window pop up automatically that displays the short message. This is different from e-mail in that the interface is designed only for short messages, and the message is intrusive - it interrupts whatever the recipient is doing, whereas e-mail usually arrives in the background and is viewed at the recipient's leisure. An instant message is different from chat systems in that the recipient does not explicitly start the application.

Synchronous Communication Tool - Allows multiple parties to set up (usually two-way) channels to exchange information in real time. It supports various features, such as online application sharing, chat, instant messaging, meeting and white boards. It uses two (or more) people to communicate synchronously and they have to be in the same place (physically or virtually) at the same time.